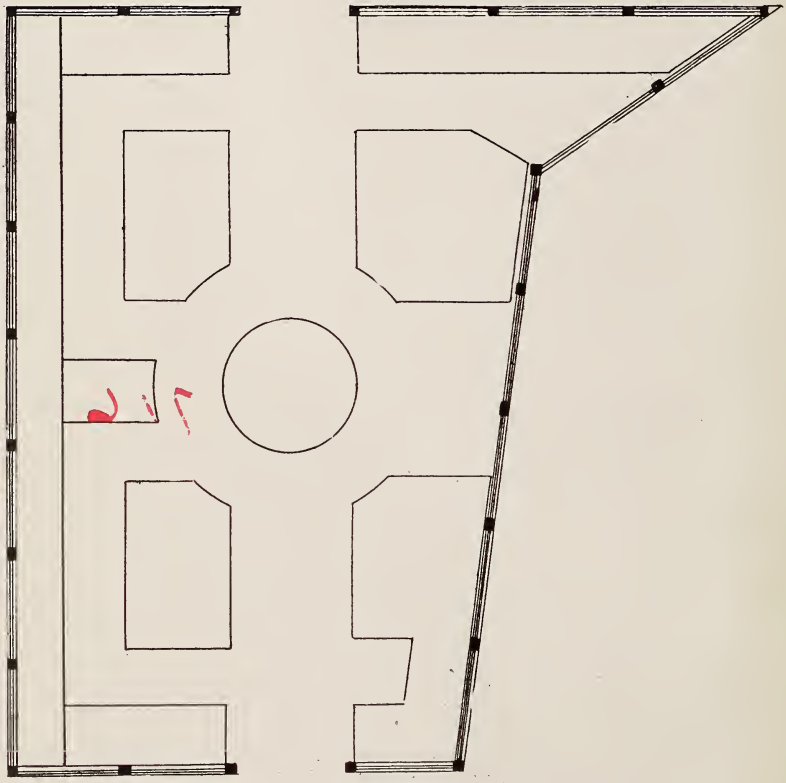
PLAN OF INSTALLATION
MONTANA STATE HORTICULTURE EXHIBIT
AT LOUISIANA PURCHASE EXHIBITION
APRIL 30 TO DEC. 1 - 1904.



Third Biennial Report

of The

MONTANA STATE BOARD OF

Horticulture

to The

Legislative Assembly

of The

STATE OF MONTANA

For the years

1903-1904

"INDEPENDENT PUBLISHING COMPANY, HELENA, MONTANA."

OFFICERS AND MEMBERS OF THE BOARD.

Henry White, First District, Billings.
E. N. Brandegee, President, Second District, Helena.
C. H. Campbell, Third District, Great Falls.
C. C. Willis, Fourth District, Plains.
J. O. Read, Fifth District, Hamilton.
O. C. Estey, Sixth District, Big Fork.
Hon. Jos. K. Toole, Ex-Officio Member, Helena.
Chas. H. Edwards, Secretary, Butte.

INSPECTORS.

E. N. Brandegee, Inspector-at-Large for the State, Helena.
Henry White, First District, Billings.
H. C. Gardiner, Second District, Bozeman.
Chas. H. Edwards, Second District, Butte.
E. N. Brandegee, Second District, Helena.
C. E. Hubard, Third District, Great Falls.
E. M. Tucker, Fourth District, Missoula.
J. O. Read, Fifth District, Hamilton.
O. C. Estey, Sixth District, Big Fork.
J. C. Wood, Sixth District, Big Fork.
Fred Hartman, Sixth District, Kalispell.

LETTER OF TRANSMITTAL.

Office of State Board of Horticulture.

Butte, Mont., January 1, 1905.

TO HIS EXCELLENCY,

JOSEPH K. TOOLE,

GOVERNOR OF MONTANA.

In accordance with law we have the honor to submit the Third Biennial Report, Volume III., of the Montana State Board of Horticulture for the years 1903 and 1904.

E. N. BRANDEGEE,
President.

C. H. EDWARDS,
Secretary.

Report of the Montana State Board of Horticulture

TO HIS EXCELLENCY,
JOSEPH K. TOOLE,
GOVERNOR OF MONTANA.

To the Governor and Legislative Assembly of the State of Montana:

In compliance with the provisions of law, I have the honor to submit for your inspection the following report of the work of the State Board of Horticulture and its officers and appointees for the years 1903 and 1904:

AN ACT

To Create the Montana State Board of Horticulture, to Prescribe Its Powers and Duties, and to Appropriate Money Therefor.

Be It Enacted by the Legislative Assembly of the State of Montana:

Section 1. There is hereby created a State Board of Horticulture, to consist of six (6) members, five of whom shall be appointed by the Governor, one from each of the horticultural districts that are hereby created, and the State Executive who shall be an ex-officio member of the board. No person shall, however, be appointed on said Board, or employed by them, who shall be connected in any way, with any nursery, or who shall be engaged in the sale or handling for profit of any nursery product.

Sec. 2. The State shall be divided into the following horticultural districts: The First District shall comprise the counties of Dawson, Custer, Yellowstone, Sweet Grass, Carbon and Park; the Second District shall comprise the counties of Gallatin, Madison, Jefferson, Beaverhead, Silver Bow, Lewis and Clarke, Meagher and Broadwater; the Third District shall comprise the counties of Cascade, Fergus, Valley, Chouteau and Teton; the

Fourth District shall comprise the counties of Missoula, Ravalli, Granite and Deer Lodge; the Fifth District shall comprise the county of Flathead.

Sec. 3. The members shall reside in the district for which they are appointed. They shall be selected with reference to their study of, and practical experience in horticulture, and the industries dependent thereon. They shall hold office for a term of four years, and until their successors are appointed and qualified, provided, however, that two of the Board first appointed—to be determined by lot—shall retire at the expiration of two years. All vacancies in the Board shall be filled by appointment of the Governor, and shall be for the unexpired term.

Sec. 4. The Board is authorized to employ a secretary and prescribe his duties, who shall hold his appointment at the pleasure of the Board. Before entering upon the discharge of his duties, each member and employe of the Board shall take and subscribe to the oath of office, which said oath shall be filed with the Secretary of State.

Sec. 5. The Board may call together and hold, in conjunction with horticultural societies, public meetings of those interested in horticulture and kindred pursuits, and may publish and distribute such proceedings and discussions as in its judgment may seem proper, provided the sum so expended shall not exceed the sum of $300 per annum.

The Board shall meet on the third Monday of February and September of each year, and as much oftener as it may deem expedient.

Sec. 6. The office of the Board shall be located at such place as the majority thereof may determine, and shall be in charge of the Secretary during the absence of the Board.

Sec. 7. For the purpose of preventing the spread of contagious diseases among fruit and fruit trees, and for the prevention, treatment, cure and extripation of fruit pests and the diseases of fruits and fruit trees, and for the disinfection of grafts, scions, or orchard debris, empty fruit boxes or packages, and other suspected material or transportable articles dangerous to orchards, fruits and fruit trees, said Board may prescribe regulations for the inspection and disinfection thereof, which regulations shall be circulated in printed form, by the Board, among

the fruit growers and fruit dealers of the State, and shall be published at least ten days in two horticultural papers of general circulation in the State, and shall be posted in three conspicuous places in each county of the State, one of which shall be at the county court house thereof.

Sec. 8. The said Board shall elect from their own number or appoint from without their number, to hold office at the pleasure of the Board, one competent person in each district to be known and to act as "Inspector of Fruit Pests." Said inspectors shall be selected with reference to their study and practical experience in horticulture. It shall be the duty of said inspectors to visit the nurseries, orchards, stores, packing houses, warehouses and other places where horticultural products and fruits are kept and handled within their repective districts, and to see that the regulations of the State Board of Horticulture to prevent the spread of fruit pests and diseases of trees and plants, and the disinfection of fruits, trees, plants, grafts, scions, orchard debris and empty fruit boxes and other material shall be fully carried out and complied with. Said inspectors shall have free access, at all times, to all the premises where any trees, plants, fruits or horticultural products or supplies are kept or handled, and shall have full power to enforce the rules and regulations of the State Horticultural Board, and to order the destruction or disinfection of any or all trees, plants, fruits or horticultural products or supplies found to be infected with any disease, as prescribed or designated by said Board.

Sec. 9. It shall be the duty of every person or persons, corporation or corporations, who shall sell or deliver to any person or persons, corporation or corporations, any trees, plants, vines, scions or grafts, to notify the inspector of said district wherein such trees, plants, vines, etc., etc., are to be delivered at least five days before said goods are to be delivered, giving the date and nursery or railroad station where said trees, plants, scions, etc., etc., are to be delivered, together with the name of the party or parties who are to receive the same. It shall be the duty of the inspector receiving said notice to inspect the said trees, plants, grafts, scions, etc., etc., as soon thereafter as practicable, and at the point where the same are to be delivered, and if the same be found free from any and all diseases or pests, as

designated by said State Board of Horticulture, he shall so certify and shall attach such certificate to each lot or bill of such trees, plants, scions, grafts, etc., etc., which said certificate must contain a list of said trees, grafts, scions, plants or vines so inspected. But if any of the trees, grafts, scions, vines or plants so inspected shall be found to be diseased or infested with any of the pests, as prescribed by said Board, then the inspector shall order the destruction of such trees, grafts, scions, vines, etc., etc., so diseased or infested, together with all boxes, wrapping or packing pertaining thereto.

Sec. 10. If any person or persons in charge or control of any nursery, orchard, storeroom, packing house or other place where horticultural products or supplies are handled or kept, shall fail or refuse to comply with the rules and regulations of the said State Board of Horticulture, or shall fail or refuse to disinfect or destroy any diseased or infected trees, plants, vines, scions, grafts, shrubs or other horticultural supplies or products, when ordered so to do by the inspector of such district, he shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than $25 nor more than $300.

Sec. 11. It shall be the duty of every owner or manager of every orchard, nursery, storeroom, packing house or other place where horticultural products or supplies are kept or handled, which shall become diseased or infected with any injurious insect or pest, to immediately, upon discovery of the existence of such disease or pest, to notify the inspector of said district of the existence of the same. It shall be the duty of such owner or manager at his own proper expense, to comply with and carry out all the instructions of said inspector for the eradication of said disease or pests. Any person who shall fail or refuse to comply with the instructions of said inspector for the eradication of any disease or pest, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than $25 nor more than $300.

Sec. 12. If any person or persons, corporation or corporations shall fail or refuse to forthwith comply with the instructions of said inspector, for the eradication of any disease or pest, said inspector shall proceed forthwith to eradicate such disease or pest and the expense of the same shall become a charge and a lien upon the property of such owner.

Sec. 13. Every person who, for himself or as agent for any other person or persons, corporation or corporations, transportation company or common carrier, shall deliver or turn over to any person or persons, corporation or corporations, any trees, vines, shrubs, nursery stock, scions, grafts, without first having attached the inspector's certificate, as provided in Section 9 of this Act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than $25 nor more than $300.

Sec. 14. No person or persons, corporation or corporations, shall be liable to any other person or persons, corporation or corporations for any damage to any trees, vines or shrubs, nursery stock, scions or grafts by reason of the same being held to await the certificate of the inspector, as provided in Section 9 of this Act.

Sec. 15. The Inspectors of fruit pests appointed or elected by said Board, shall receive as compensation for their services the sum of $5.00 (five dollars) per day for the time actually employed; provided, however, that no inspector shall receive more than three hundred dollars in any one year, when acting as such inspector of fruit pests. The members of said Board shall receive no compensation for their services except actuual expenses paid out. The secretary of said Board shall receive the sum of $1,000 per annum for his services.

Sec. 16. All bills for expenditures, under this Act, shall be audited and passed upon by said Board of Horticulture, and if found legal and just, shall be allowed, subject to the approval of the State Board of Examiners, and a warrant shall be drawn therefor upon the auditor of the State of Montana, who shall draw his warrant upon the State Treasurer therefor.

Sec. 17. It shall be the duty of the Secretary to attend all meetings of the Board and procure records of the proceedings and correspondence, to collect books, pamphlets, periodicals and other documents containing valuable information relating to horticulture, and to preserve the same; to collect statistics and other information showing the actual condition and progress of horticulture in this State and elsewhere; to correspond with agricultural and horticultural societies, colleges and schools of agriculture and horticulture and other persons and bodies as may

be directed by the Board, and prepare, as required by the Board, reports for publication; he shall also act as assistant to, and obey the directions of the inspectors of fruit pests, under the direction of the Board.

Sec. 18. The Board shall biennially, in the month of January, report to the Legislature a statement of its doings and abstracts of the reports of the inspectors of fruit pests, and of the Secretary.

Sec. 19. There is hereby appropriated for the use of the State Board of Horticulture, as set forth in this Act, out of the moneys in the State Treasury not otherwise appropriated, the sum of three thousand ($3,000) dollars, or as much thereof as may be necesary for the year commencing March 1, 1899, three thousand six hundred ($3,600) dollars, or as much thereof as may be necesary for the year commencing March 1, 1900.

Sec. 20. All sums of money collected as fines for violations of any of the provisions of this Act shall be turned into the state treasury for use in defraying the expenses of the Board hereby created, and the appropriations hereby made shall be paid out of the fund to the extent of the money therein contained.

A BILL FOR

An Act Entitled, "An Act to Amend Sections 7, 8, 9 and 19 of an Act to Create the Montana State Board of Horticulture to Prescribe Its Powers and Duties, and to Appropriate Money Therefor."

Be it Enacted by the Legislative Assembly of the State of Montana:

That Section seven of an "Act to create the Montana State Board of Horticulture, to prescribe its powers and duties, and to appropriate money therefor," as enacted by the Sixth Legislative Assembly of the State of Montana, be amended to read as follows:

Section 7. For the purpose of preventing the spread of contagious diseases among fruit and fruit trees, and for the prevention, treatment, cure and extripation of fruit pests and diseases of fruit and fruit trees, and for the disinfection of grafts, scions and orchard debris, empty fruit boxes or packages, and other sus-

pected material or transportable articles dangerous to orchards, fruit and fruit trees, said Board may prescribe regulation for the inspection, disinfection or destruction thereof, which regulation shall be circulated in printed form, by the Board, among the fruit growers and fruit dealers of the State, and shall be published at least ten days in two horticultural papers of general circulation in the State, and shall be posted in three conspicuous places in each county in the State, one of which shall be at the County Court House thereof.

That Section eight of said Act be amended so as to read as follows:

Section 8. The said Board shall elect from their own number or appoint from without their number, to hold office at the pleasure of the Board, one competent person in each district, to be known and act as "Inspector of Fruit Pests." Said inspectors shall be selected with reference to their study and practical experience in horticulture. It shall be the duty of said Inspectors to visit the nurseries, orchards, stores, packing houses, warehouses and other places where horticultural products and fruits are kept and handled within their respective districts, and to see that the regulations of the State Board of Horticulture to prevent the spread of fruit pests and diseases of trees and plants, and the disinfection of fruits, trees, plants, grafts, scions, orchard debris and empty boxes and other material shall be fully carried out and complied with. Said inspectors shall have free access, at all times, to all premises where any trees, plants, fruits or horticultural products or supplies are kept or handled, and shall have full power to enforce the rules and regulations of the State Horticultural Board, and to order the destruction and disinfection of any or all trees, plants, fruits or horticultural products or supplies found to be infected with any disease as prescribed or designated by said Board.

The said Board may appoint one or more, as necessary, competent persons to be known as "Special Fruit Inspectors" whose general powers and duties shall be the same as those prescribed in this section to govern "Inspectors of Fruit Pests," and whose especial duty shall be the inspection of fruits offered for sale in the State of Montana.

Such special fruit inspector shall receive such sum per day as

the said Board of Horticulture may agree upon, provided such sum shall in no case exceed the sum of five dollars per day, for the time actually employed, and further provided that such compensation shall not exceed the amounts charged and collected as fees for such inspection.

That section nine of said act be amended so as to read as follows:

Section 9. It shall be the duty of every person or persons, corporation or corporations, who shall sell or deliver to any person or persons, corporation or corporations, any trees, plants, vines, scions, or grafts, to notify the inspector of said district wherein such trees, plants, vines, etc., etc., are to be delivered, at least five days before said goods are to be delivered, giving the date and nursery or railroad station where said trees, plants, scions, etc., etc., are to be delivered, together with the name of the party or parties who are to receive the same. It shall be the duty of the inspector receiving said notice to inspect the said trees, plants, grafts, scions, etc., etc., as soon thereafter as practicable and at the point where the same are to be delivered, and if the same be found free from any and all diseases or pests, as designated by said State Board of Horticulture, he shall so certify and shall attach such certificate to each lot or bill of such trees, grafts, plants, scions, etc., which said certificate must contain a list of the said trees, grafts, scions, vines or plants so inspected. But if any of the trees, grafts, scions, vines or plants so inspected shall be found to be diseased or infested with any of the pests, as prescribed by said Board, then the inspector shall order the disinfection or destruction of such trees, grafts, scions, vines, etc., etc., so diseased or infected, together with all boxes, wrapping or packing pertaining thereto, provided, that the State Board of Horticulture shall have power to designate certain places as quarantined stations, where all nursery stock brought into the State shall be inspected and disinfected. The State Board of Horticulture shall charge and collect from each nursery inspected the sum of ten dollars, and a proportionate sum for less than car lots, but in no instance less than two dollars for each separate inspection or disinfection. For the inspection of fruits a fee of two cents per box or package with a maximum fee of five dollars for each separate lot or car shall be charged and

collected. The inspectors shall collect such fees and shall not give certificates of inspection until the fees are paid.

That section nineteen of said act be amended so as to read as follows:

There is hereby appropriated for the use of the State Board of Horticulture, as set forth in this act, out of the moneys in the State treasury, not otherwise appropriated, the sum of twenty-five hundred dollars, or so much thereof as may be necessary, for the year commencing March 1st, 1901. Three thousand dollars, or as much thereof as may be necessary, for the year commencing March 1st, 1902, said appropriation of money to be payable out of the revenues of the State of Montana for the year 1902.

Section 20. All acts and parts of acts in conflict herewith are hereby repealed.

HOUSE BILL NO. 113.

A BILL FOR

An Act to amend Section one, two, seven, eight, nine, fifteen, and nineteen of An Act Entitled "An Act to Create the Montana State Board of Horticulture," to prescribe its duties and powers and to appropriate money therefor, approved February 17, 1899; and as amended by an Act of March 14, 1901; and to add to said act certain new sections to be designated as sections 21 to 28 inclusive.

Be it Enacted by the Legislative Asembly of the State of Montana:

Section 1. That Section one of said act be amended so as to read as follows:

Section 1. There is hereby created a State Board of Horticulture, to consist of seven members, six of whom shall be appointed by the Governor, one from each of the horticultural districts that are hereby created, and the State Executive who shall be an ex-officio member of the Board. No person shall, however, be appointed on said Board, or employed by them, who shall be connected in any way with any nursery, or who shall be engaged in the sale or handling for profit of any nursery product.

Section 2. That Section two of said act be amended so as to read as follows:

Section 2. The State shall be divided into the following horticultural districts: The First district shall comprise the counties of Dawson, Custer, Yellowstone, Sweet Grass, Carbon, Park and Rosebud; the Second district shall comprise the counties of Gallatin, Madison, Jefferson, Beaverhead, Silver Bow, Lewis and Clarke, Meagher and Broadwater; the Third district shall comprise the counties of Cascade, Fergus, Valley, Chouteau and Teton; the Fourth district shall comprise the counties of Missoula, Granite, Powell and Deer Lodge; the Fifth district shall comprise the county of Ravalli; and the Sixth district shall comprise the county of Flathead.

Section 3. That Section seven of said act, as the same is now in force after amendment by act of March 14, 1901, be amended so as to read as follows:

Section 7. For the purpose of preventing the spread of contagious diseases among fruit and fruit trees, and for the prevention, treatment, cure and extripation of fruit pests, and diseases of fruit and fruit trees, and for the disinfection of grafts, scions and orchard debris, empty fruit boxes or packages, and other suspected material or transportable articles dangerous to orchards, fruit and fruit trees, said Board may prescribe regulations for the inspection, disinfection, or destruction thereof, which regulation shall be circulated in printed form, by the Board, among fruit growers and fruit dealers of the State, and shall be published at least ten days in two horticultural papers, of general circulation in the State, and shall be posted in three conspicuous places in each county in the state, one of which shall be at the County Court House thereof.

For further prevention of the spread of diseases dangerous to fruit and fruit trees, it shall be unlawful for any person or persons, dealer or dealers, to allow, or cause to be used the second time any crate, box, barrel, package or wrapping once having contained fruit of nursery stock, and that the destruction of the same must be made in its entirety, and that the finding of such crate, box, barrel, package or wrapping in possesion of any person or persons, dealer or dealers, other than the consignee, shall be considered prima facie evidence of a violation of this act.

Any member of the Board of officers thereof, is hereby authorized to seize and destroy by burning without breaking said crate,

box, barrel, package or wrapping wherever found, and to prosecute said violator or violators.

Section 4. That section eight of said act, as the same is now in force after amendment by the act of March 14, 1901, be amended so as to read as follows: Section eight. The said board shall elect from their own number, or appoint from without their number, to hold office at the pleasure of the Board, one competent person in each district, to be known and act as Inspector of fruit pests. Said inspectors shall be selected with reference to their study, and practical experience in horticulture. It shall be the duty of said inspectors to visit the nurseries, orchards, stores, packing houses, warehouses and other places where horticultural products and fruits are kept and handled within their respective districts, and to see that the regulations of the State Board of Horticulture to prevent the spread of fruit pests and diseases of trees and plants, and the disinfection of fruits, trees, plants, grafts, scions, orchard debris, and empty fruit boxes and other material shall be fully carried out and complied with. Said inspectors shall have free acess, at all times, to all premises where any trees, plants, fruits or horticultural products or supplies are kept or handled, and shall have full power to enforce the rules and regulations of the State Horticultural Board, and to order the destruction and disinfection of any or all trees, plants, fruits or horticultural products or supplies found to be infected with any disease as prescribed or designated by said board.

The said board may appoint one or more as necessary, competent persons, to be known as Special Inspectors, whose general powers and duties shall be regulated and prescribed by the member of the Board for that district. Such special inspector shall receive such sum per day, as the said Board of Horticulture may agree upon, provided such sum, shall in no case exceed the sum of five dollars per day, for the time actually employed.

The said Board shall appoint one person to be known as Inspector at Large for the State, whose duties shall be prescribed by the Board, and who shall receive the sum of five dollars per day for the time actually employed.

Section 5. That Section nine of said act, as the same is now in force after an amendment by the act of March 14, 1901, be amended so as to read as follows: Section 9. It shall be the

duty of every person or persons, corporation or corporations, who shall sell or deliver to any person or persons, corporation or corporations, any trees, plants, vines, scions or grafts, to notify the secretary of the board, whose duty it shall be to notify the inspector of said district wherein such vines etc., etc., are to be delivered at least five days before said goods are to be delivered, giving the date and nursery, or railroad station where said trees, plants, scions, etc., etc., are to be delivered, together with the name of the party or parties who are to receive the same. It shall be the duty of the inspector receiving said notice, to inspect the said trees, plants, grafts, scions, etc., etc., as soon thereafter as practicable, and if the same be found free from any and all diseases or pests, as designated by said State Board of Horticulture, he shall so certify and shall attach such certificate to each lot or bill of such trees, grafts, plants, scions, etc., which said certificate must contain a list of the said trees, grafts, scions, vines, or plants so inspected. But if any of the trees, grafts, scions, vines or plants so inspected, shall be found to be diseased or infested with any of the pests, as prescribed by the said Board, then the Inspector shall order the disinfection or destruction of said trees, grafts, scions, vines, etc., etc., etc., so diseased or infected, together with all boxes, wrapping or packing pertaining thereto, and charge and collect the sum of ten dollars ($10) for the disinfection and inspection of each car load of said nursery stock, and a proportionate sum for less than car lots, but in no instance for less than $2.00, for each separate inspection or disinfection, provided, that the State Board of Horticulture shall have power to designate certain places as quarantined stations, where all nursery stock brought into the State shall be inspected and disinfected.

For the inspection of fruits, a fee of two cents per box or package with a maximum fee of five dollars for each separate lot or car shall be charged and collected. The inspectors shall collect such fees and shall not give certificates of inspection until the fees are paid.

Section 6. That section fifteen of said act, as the same is now in force after amendment by the act of March 14, 1901, be amended so as to read as follows: Section 15. The inspectors of fruit pests appointed or elected by said Board, shall receive as com-

pensation for their services such sum as the Board may regulate, provided, not to exceed five dollars per day for the time actually employed. The members of said Board shall receive no compensation for their services, except actual expenses paid out. The secretary of said Board shall receive the sum of $1,000 per annum for his services.

Section 7. That section nineteen of said Act, as the same is now in force after amendment by the act of March 14, 1901, be amended so as to read as follows:

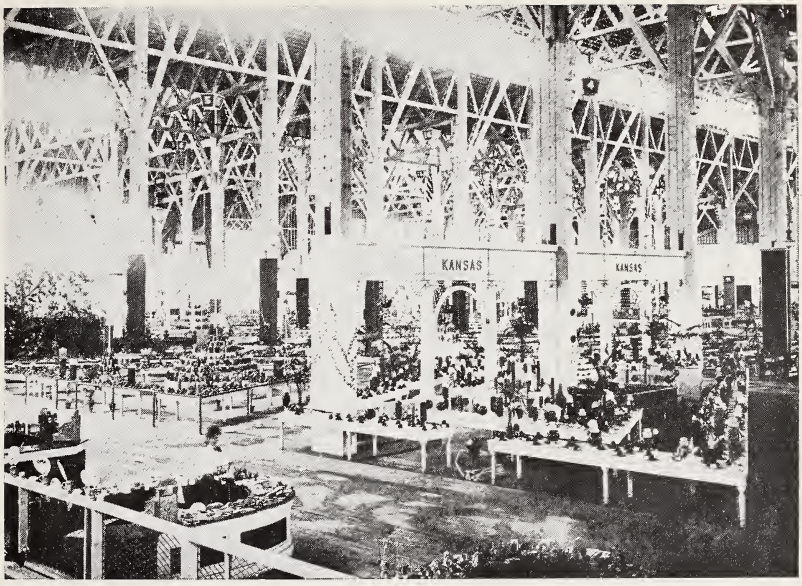
Section 19. There is hereby appropriated for the use of the State Board of Horticulture as set forth in this Act, out of the moneys in the State Treasury, not otherwise appropriated, the sum of five thousand dollars, $3,500, or so much thereof as may be necessary, for the year commencing December 1, 1902, and $2,500 or so much thereof as may be necessary for the year commencing December 1, 1903.

Section 8. That there shall be added to said act of February 17, 1899, as new enactments the following additional Sections to be designated as Sections 21, 22, 23, 24, 25, 26, 27 and 28:

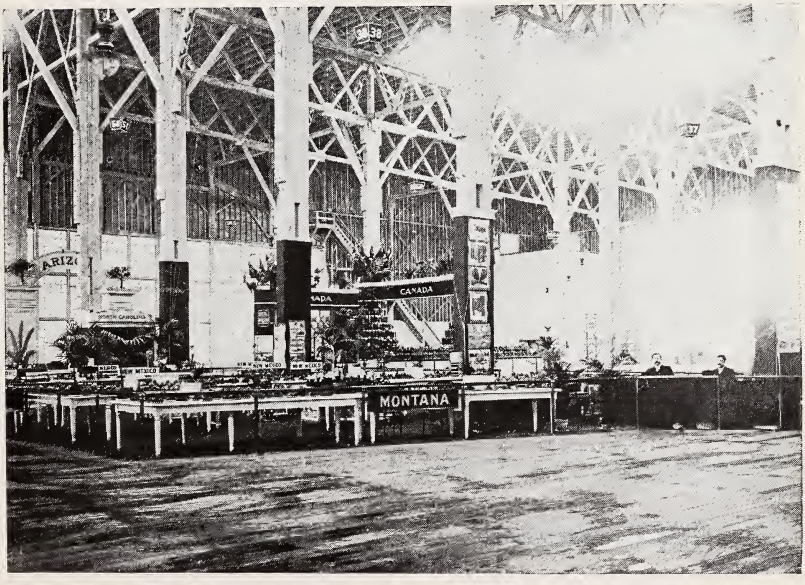
Section 21. Every person who for himself, or as agent for any other person or persons, transportation company or common carrier, shall deliver or turn over to any person or persons, corporation or corporations, any fruits without first having attached the inspector's certificate, shall be deemed guilty of a misdemeanor.

Section 22. No person, firm or corporation shall engage or continue in the business of selling within the State, or importing fruit trees, plants or nursery stock into the State, without first having obtained a license to do business in this State, as in this act provided.

Section 23. Any person, firm or corporation, may obtain a license to engage in the business of selling fruit trees, plants or nursery stock into this State, upon the payment of the sum of twenty-five dollars, and by filing with the secretary of the State Board of Horticulture, bond with sureties, in the sum of one thousand dollars ($1,000), conditioned that the principals will faithfully obey the laws of the State of Montana, and that the said principals will pay the cost of fumigation of all nursery stock or other materials, or goods imported into or sold within



Sectional View of Horticultural Palace, World's Fair, 1904.



Full View Montana Horticultural Exhibit, World's Fair, 1904.

the State by the said principal or his or their agent, and the expense of destruction of any infested nursery stock. License granted under this act shall be for one year, provided, however, that such license may be revoked at any time for any violation of this act, at the discretion of the Board.

Section 24. It shall be the duty of every person, firm or corporation licensed to do business under this act to notify the secretary of the State Board of Horticulture of his intention to ship an invoice of fruit trees, plants or nursery stock, from one point to another in this State, or from any point without this State into this State. The said notice shall contain the name and address both of the consignor and consignee, and the invoice of the goods to be shipped, the freight or express office at which the goods are to be delivered, and the name or title of the transportation company from whom the consignee is to receive such goods.

Such notice shall be mailed at least five days before the day of shipment.

Section 25. It shall be the duty of each person or corporation offering to sell, or selling and delivering, any nursery stock, fruit trees, plants, vines, scions, cuttings, etc., etc., within the State of Montana, to place on each and every package so sold and delivered, a label or card, containing the name and address of both the consignor and consignee, and the invoice of the stock therein contained.

Section 26. Any person or persons who shall receive and accept any nursery stock, fruit trees, plants, vines, scions, cuttings, grafts, etc., etc., that have not been inspected by a duly appointed inspector of the State Board of Horticulture, and shall use or dispose of said nursery stock, fruit trees, vines, plants, scions, cuttings, grafts, etc., etc., without first notifying the inspector and furnishing him opportunity to examine, and if necessary fumigate the said nursery stock, will be deemed guilty of a misdemeanor and will be subject to fine as further provided in this act.

Section 27. All nursery stock, trees, plants, vines, and cuttings grown or growing within the State of Montana, used for filling orders shall, after said stock shall have been taken from the nursery rows or grounds, and before the same shall have been packed for delivery, be inspected by a duly appointed inspector

and shall be disinfected by fumigating or other method, when in his judgment such is necessary. After such inspection, if it be found that said nursery stock, trees, plants, vines and cuttings, are clean and free from insects and fungi pests, he shall issue his certificate to said nurseryman, and said certificate shall entitle him to use said stock, so inspected and disinfected for filling orders for next current delivery.

Nurseries shall give to the secretary of the Board five days' notice of the time when said stock shall be ready for inspection under the provision of this act.

Section 28. Any person or persons, corporation or corporations, transportation companies or common carriers, violating any of the provisions of this Act, shall be deemed guilty of a misdemeanor and fined in the sum of not less than twenty-five ($25) dollars nor more than three hundred dollars ($300).

Section 9. All Acts and parts of Acts in conflict herewith are hereby repealed.

Section 10. This Act shall take effect and be in force from and after its passage and approval.

RULES OF THE MONTANA STATE BOARD OF HORTICULTURE.

Under the law, the term nursery stock is construed to mean and include fruit, shade, and ornamental trees (deciduous or evergreen), shrubs, vines, plants, roots, bulbs, buds, scions, cuttings, or other portions of plants, shrubs or trees designed to be replanted in Montana for home or commercial use.

For the purpose of preventing the importation and spread of contagious diseases among fruits, fruit trees and nursery stock, and for the treatment, cure and extirpation of fruit pests, the Montana State Board of Horticulture, established (in accordance with an Act to create the Montana State Board of Horticulture, to prescribe its powers and duties, approved February, 1899), the following rules and regulations and ask the earnest co-operation of all fruit growers, dealers, and all persons interested in maintaining the present high grade of Montana fruit, in carrying out the important work.

Rule 1. It shall be the duty of the stock inspector after re-

ceiving notice of the arrival of any nursery stock to immediately have the same inspected or fumigated and he shall, if he finds after inspection said nursery stock free from any and all diseases, place his certificate upon each and every package, showing that the said nursery stock has been inspected or fumigated, giving name of the inspector, the date of inspection and place, but if the said nursery stock be found to be infected with any of the diseases or insects injurious to orchards as prescribed by the Board of Horticulture, other than the San Jose Scale, Woolly Aphis, Black Knot of the plum and Black Knot of the cherry, the said diseased stock shall be properly treated, but if the said nursery stock shall be infected with San Jose Scale, Woolly Aphis, Black Knot of plum, Black Knot of cherry, Crown Gall, or Root Knot, then the Inspector shall destory the same by burning; together with all wrapping and packing, and shall issue a certificate to the shipper or owner showing cause for destruction.

Rule 2. All nursery stock, trees, plants, vines and cuttings of any kind shipped into or brought into the State of Montana, before delivery to the purchaser shall be unpacked from the boxes and in case of baled and burlapped shipments, these coverings shall be removed and stock shall be inspected and fumigated at Miles City, Billings, Dillon, Missoula, Kalispell, Great Falls or Glasgow, which points are hereby designated as quarantine stations.

All nursery stock, trees, plants, vines and cuttings brought into Montana by any transportation company, shall be inspected and fumigated at the point of delivery, provided said point of delivery shall be one of the above designated quarantine stations; but, if any shipments shall be filled for delivery at any other points in Montana, they shall be inspected or fumigated at the quarantine station on the line of such transportation company next preceding or nearest the point of delivery to which they are billed.

All such nursery stock, plants, trees, vines, cuttings, brought into the State of Montana, by wagon shall be inspected and treated at the nearest quarantine station, as hereinbefore mentioned, to the point where such nursery stock, trees, plants, vines and cuttings enter the State.

The certificate of the Inspector making such examination and

inspection shall exonerate the shipper and consignee from any and all penalties provided by law.

Rule 3. Importers or owners of nursery stock, trees, vines, plants and cuttings who shall desire to have such nursery stock, trees, plants, vines, and cuttings, inspected and fumigated at points in Montana other than the regular quarantine stations, may have such inspection and fumigation made at any point designated by such importer or owner; provided, however, that such importer or owner shall pay all charges of inspection and fumigation and all expenses of the officer employed in such inspection and fumigation, such charges and expenses to be paid before the certificate is granted.

Rule 4. The Inspector of each district shall inspect or cause to be inspected, each and every orchard within his district annually, unless otherwise ordered by the Board. He shall see that the owner or owners of any premises where trees, plants, vines, etc., are growing shall obey the instructions of the State Board.

Rule 5. It shall be unlawful for any person to spray any tree plant or shrub when the same is in bloom, with any substance injurious to bees or honey.

Rule 6. In the absence of the Inspector of any district or in the event that he cannot or does not perform, for any reason, the work required, the member of the State Board of Horticulture for said district may appoint temporarily such assistant inspectors as may be necessary for such work.

Rule 7. All Inspectors shall, at the close of each week, report to the Secretary of said Board a complete statement of his doings, upon the proper blanks furnished for that purpose, together with an itemized bill for his labor for the time actually served by him during such week, which bill, when properly audited by the member of the State Board of Horticulture for the district in which said Inspector shall labor, be again audited by the President and Secretary of the State Board and forwarded to the State Board of Examiners for payment.

Rule 8. All inspection and fumigation shall be under the charge and supervision of the Inspector at large, and all Inspectors shall be responsible to him.

Rule 9. The Inspectors appointed by this Board are author-

ized to inspect in their respective districts any and all nursery stock, trees, plants, shrubs, vines and fruits, and to collect the fees prescribed in the law, from the owner or person in control of such nursery stock or fruits wherever found. All fruits inspected and found free of any disease or infection shall be branded "Inspected and Passed" together with the date of the inspection and number of district in which inspected, but if found to be infested with any injurious insects, or disease, shall be condemned and destroyed by burning by the inspector without exception.

Rule 10. The special fruit inspectors appointed by the Board shall, in all districts, excepting district No. 2, receive as compensation for the work of inspection of fruits the sum total of the fees collected; provided, however, that the sum shall not exceed $5.00 per day for each days work, devoted to inspection.

Fumigation.

By fumigation it is to be understood treatment with hydrocyanic acid gas. This treatment should be done as follows: All nursery stock to be treated should be placed in an air tight tent or box. For every one hundred cubic feet of space in box or tent, take one ounce "Avoirdupois weight," and fused potassium cyanide, ninety-eight per cent strength, preferably in lumps about the size of a walnut; one and one-half ounces commercial sulphuric acid, best grade, and two and one-fourth fluid ounces of water. First: Place the water in a three-gallon vessel (which may be glazed earthenware); to this add the acid and finally the potassium cyanide. (The cyanide would be better enclosed in a small paper bag in which a hole is torn.) Immediately close the doors or openings, taking all precautions against inhaling the gas, as it is one of the most violent poisons known. After leaving box or tent closed for forty minutes, open all doors and allow at least one hour for thorough ventilation before attempting to remove stock. No injury is caused to nursery stock if the gas is left in more than forty minutes.

Beginning with January 1, 1903, and continuing throughout February and into March, the time of the Board and this office was devoted to necessary legislative matters.

As soon as the amended bill became law, the same was edited

and prepared for the printer, and 1,000 copies were printed. Necessary blanks, such as licenses, bonds, and Inspector's blanks, all in conformity with the new law, were also printed and these, with copies of the law, were distributed to nurserymen, Inspectors, fruit dealers and Board members. In addition to distributing the law and printed matter, 3,000 reports were mailed out.

In the early part of January the following circular was sent to all newspapers of the State and all Experiment Stations of the United States:

Montana State Board of Horticulture, 79 West Broadway.

Butte, Montana, June 3, 1903.

Gentlemen: This Board would be pleased to receive your publication regularly as an exchange. The favor will be greatly appreciated and in turn any information that we may be able to furnish you will be gladly given.

Should you desire to extend this courtesy to the Board will you kindly notify us when this office is placed on your list,

Yours very truly,

C. H. EDWARDS,

Secretary.

The object was to receive all bulletins and periodicals that might prove of interest to the Board. As a result of the letter there now comes to the Board all the principal papers and bulletins. The bulletins are all filed according to the subject matter contained and all notes of interest to our work contained in the papers are preserved for reference.

A special letter was written and mailed, with copy of law and bond to each nursery of the State and to all nurseries outside of the State who were known to be carrying on trade in the State, calling their attention to the requirements of the law and requesting prompt compliance. Nurseries were quite prompt in obeying the law and all reliable firms were found to be satisfied with the law. It can be safely said that the law, as it stands, applied to nurserymen is efficient and has placed the nursery business of the State on a much better basis than was the case previous to its amendment.

In the month of May correspondence was began with the various railroads regarding freight rates. At the midwinter meeting of the Horticultural Society, held in Stevensville, Mr.

W. M. Wooldridge, Mr. C. C. Willis and myself were appointed as a committee on freight rates.

June 10th the following letter was addressed to the Great Northern:

Mr. F. B. Clark, Gen. Traffic Mangr., St. Paul, Minnesota:

Dear Sir: At the Montana Horticulture Society's mid-winter meeting, held at Stevensville, Montana, last February, there was disposition manifested to criticise the railroads operating in Montana for not establishing a freight rate on carload shipments of apples that would enable the farmers and fruit growers of the fruit growing sections, especially of the Bitter Root Valley, which is on the Northern Pacific, to reach the North Montana markets, which is a large market for such products as they produce. Those friendly to the railroads contended against this disposition and cited instances which went to show that when such matters were properly presented to the proper officials, that they were ever willing to make such rates as would enable a farmer and horticulturist to find a market, especially within our own state. I took this view of it and in consequence was appointed as one of the committee to try and reach an understanding with the roads; the other members of the Committee being Mr. C. C. Willis, of Plains, Missoula County, who is known to Mr. S. L. Moore and Hanniford, of the Northern Pacific, and Mr. C H. Edwards, Secretary of the State Board of Horticulture at Butte, and myself.

When in Helena recently Mr. W. B. Harlan, the President of the State Horticulture Society, spoke to me regarding this and asked that I take the matter up at once. I had understood that Mr. Edwards had done so, but it seems that this is not the case.

I was very much surprised to hear it stated, and I believe by conservative men, that not less than 100,000 bushels of apples were permitted to go unharvested and rot upon the ground in the Bitter Root Valley the past year, simply because they were not able to find a profitable market for them. With the large importations of apples into other parts of Montana there certainly seems to be no good reason for this. The burden of complaint seemed to be that the Northern Pacific had made a very reasonable rate along their line which helped fruit growers out there very materially, but that the Great Northern would do

nothing along their line. Will you kindly advise me if something cannot be done to meet these peoples' wishes and how far you are willing to go.

I wish to add that a special effort is being made at this time throughout the whole of Montana to build up the agriculture resources of this State and the assertion is quite often made, "what is the use of trying to build up agriculture within the State when you cannot market it within your own state; the railroads will not make rates that will enable us to secure a profitable market."

My own personal experience in the Milk River Valley has been that our road has always shown a disposition to meet the farmers and producers more than half way. Yours truly,

W. M. WOOLDRIDGE,
Industrial Agent.

The same date the following was addressed to the Northern Pacific:

Montana State Board of Horticulture, Room 104, Clark Block.
Butte, Montana, June 10, 1903.

Mr. J. M. Hannaford, Sec. Vice President N. P. Ry, St. Paul, Minnesota:

Dear Sir: At the last meeting of the Montana State Horticutural Society, held in Stevensville, Mr. W. M. Wooldridge, Mr. C. C. Wlilis and myself were appointed a committee to take up with your road and the Great Northern the matter of freight rates. Mr. Wooldridge, being near to the Great Northern people, has taken up the work with them and this leaves Mr. Willis and myself to discuss the subject with you.

The prevailing impression is, that with the exception of the rate on Bitter Root fruits to Butte and Helena, that the orchard, garden and farm products of Idaho, Washington, Oregon and Utah enjoy a better rate to all Montana points than do the like products of Montana.

We cannot, however, say that this is correct, yet the opinion as before stated, prevails and at each meeting the subject comes up and seems never to be settled. The purpose of this committee is to try and secure reliable data from the various roads, both as to express and freight rates, that a basis may be had from which to work intelligently. To this end we would ask you, if consistent with your rules, to furnish to us a scale of rates, both

Sectional View, Showing Special Exhibit of Crab Apples, Montana Horticultural Exhibit, World's Fair, St. Louis, 1904.

Sectional View Montana Horticultural Exhibit, World's Fair, St. Louis, 1904.

freight and express, upon car lots and less than car lots, showing the rates charged for fruits, vegetables and general farm products from prominent shipping points in the states named above to prominent points in Montana, and also showing the rates charged for Montana products to like points.

If this can be done we can then get down to work and put an end to the everlasting charge of discrimination. We are of the opinion that Montana orchard and garden products are not able to compete in any of the markets of the State outside of Butte and Helena in car lots, except, perhaps, in few instances. The cities of Bozeman, Livingston, Billings, Miles City and many more places should afford Montana products a good market, but it is a fact that we have not been able to reach them. The products of the garden and orchard are growing rapidly and while it may seem now that they are not of much consequence in the matter of trade the time will soon be here when we will have to look outside the State for markets for our fruits.

We would like if something could be done towards getting our fruits into the northern parts of the State.

Trusting to hear from you early, we are, yours truly,

(Signed.) C. C. WILLIS,
C. H. EDWARDS.

The Northern Pacific replied as follows June 15th:

St. Paul, Minn., June 15, 1903.

C. H. Edwards, Esq., Montana State Board of Horticulture, Room 104, Clark Block, Butte, Montana:

Dear Sir: I am in receipt of communication of the 10th inst., signed by yourself and C. C. Willis, in regard to rates on orchard, garden and farm products of Idaho, Washington, Oregon and Utah to Montana points, as compared with rates from Montana points.

If such a condition exists I am not aware of it. However, I have referred your communication to Mr. W. E. Alair, division freight agent for Montana, who has charge of such matters. He will make a thorough investigation, and if the facts are as stated by you, I have no doubt the matter will be adjusted in a satisfactory manner. Yours truly,

J. M. HANNAFORD.

July 8th the following reply was received from Mr. Alair, Division Freight Agent of the Northern Pacific:

St. Paul, Minn., July 8, 1903.

Messrs. C. H. Edwards and C. C. Willis, Montana State Board of Horticulture, Room 104, Clark Block, Butte, Montana:

Gentlemen: As you were advised Mr. Hannaford referred to me your communication of June 10th on the subject of rates for fruit, garden and farm products from the Bitter Root Valley to Montana common points. Before replying, I have taken time to give the matter a little study, both with reference to rates and the district from which the supply of fruit and vegetables for Montana points is drawn. Your near location to the Butte and Helena markets, not only gives you decided advantage in comparison with other territories supplying those points in the matter of rates, but enables you to put products on the market much sooner and of course in better condition. I do not see how vegetables from California, Washington and the South can compete against the products of the Bitter Root Valley, which recahes there in so much shorter time and of course fresh and crisp.

You have a rate of 70c per 100 lbs., L. C. L. on fruit and vegetables from Bitter Root Valley points to Butte and a rate of 25c in carload lots. The rates from Washington are, carloads, 83½c; less than carloads, $1.30. From the Pacific Coast, $1.12½ carloads; less than carloads, $1.75. If these other points can come in to Helena and Butte and compete with the Bitter Root with this difference in rates, there must certainly be a good market and a good profit for the farmers of the Bitter Root Valley. A great many carloads do go in, not only from the Pacific Coast, but from the South and California. I think this condition of affairs should enable you to dispose of the charge of discrimination on the part of the railroad company.

I hope your prediction that the time will soon be here when the producers of the Bitter Root Valley will have to look outside the State for markets will soon be realized. At present there seems to be a good chance for them in Helena and Butte.

I shall be glad at any time to have you take up this or other questions with me and if there is anything further in regard to

the rates under discussion, please give me specific information and we will look into it further. Yours truly,

W. E. ALAIR, D. F. A.

In answer to this the following letter was addressed to Mr. Alair:

Butte, Montana, July 21, 1903.

W. E. Alair, Division Freight Agent, N. P. R. R. Co., St. Paul, Minnesota:

Dear Sir: Yours of July 8, replying to my letter to Mr. J. M. Hannaford, concerning freight rates, has been received. If you will refer to my letter to Mr. Hannaford you will note that the statement is made, "with the exception of the rate of Bitter Root fruits and vegetables to Butte and Helena that the orchard, garden and farm products of Idaho, Washington, Oregon and Utah enjoy a better rate to all Montana points than do the like products of Montana." In so far as rates to Butte and Helena are concerned, the principal shipping points, in Western Montana, no doubt, have a slight advantage. But the two places named do not afford the Montana products a sufficient market for the reason that points in other states ship largely into these markets. Now, what our people desire is to be able to place their products in the various towns of Montana on an even basis with more Western points, if not some slight advantage. This is the reason why I requested, if possible, that your road make a scale of rates on fruits and vegetables, shipped into this State, in car lots, and less than car lots, from some of the principal points West of us to such points in Montana as Butte, Helena, Anaconda, Livingston, Billings, Miles City, etc., and also a scale showing the rate on Montana products from the principal shipping points on like products to such places. Such a scale of rates would enable this committee to show our people just exactly what position they were in as to rates. You state that we have a "rate of 70c per 100 lbs., L. C. L. on fruit and vegetables from Bitter Root points to Butte and a rate of 25c in carload lots. The rates from Washington are, carloads, 83½c; less than carloads, $1.30. From the Pacific Coast, $1.12½ carloads; less than carloads, $1.75." Now, I have been informed, several times, that it is possible for shippers in Washington and Oregon to ship to Missouri River points, fruits in carloads at 65c per hundred. That said carloads

could be diverted to any Montana point for the same rate. Now, if this is true, then you will see that these people could place their products in Billings, Miles City and many other points at a lower rate than could our people. I trust that you can give us such scale of rates as asked for, so that we may be able to present this matter in a clear manner to our people. Yours truly,

(Signed.) C. C. WILLIS,
C. H. EDWARDS.

August 5th the following reply was received from Mr. Alair:

St. Paul, Minn., August 5, 1903.

Mr. C. H. Edwards, Montana State Board of Horticulture, Room 104, Clark Block, Butte, Montana:

Dear Sir: I have your favor of July 21st, continuing correspondence on the subject of fruit and vegetable rates to various points in Montana as compared with the adjustment from Bitter Root Valley, and note that you still request the rates from some of the principal points "West of us," and also rates on Montana products to such points as Butte, Helena, etc.

My letter of July 8th gives you the rates from the Pacific Coast, and also from Eastern Washington to these points, as well as the rates from Bitter Root Valley. The rates from Washington cover the principal territory with which Montana would come in competition, if it can be called competition with such a wide difference in the rates as shown in my letters. Now, if you will be good enough to just specify what other points in Montana west of Missoula ship fruit and vegetables into Butte, I shall be glad to give you those rates as well, or you can obtain the information direct from our General Agent at Butte.

Your information that there is a 65c rate applying on fruits in carloads from Washington and Oregon to Missouri River points, is certainly not correct; we have no such rate. The rates are as I have previously advised you, $1.12½ in carloads, and $1.75 in less than carloads from Pacific Coast to Missouri River, and the same rates apply to Montana points. Yours truly,

W. E. ALAIR, D. F. A.

The Great Northern replying August 11th wrote as follows

Butte, Montana, August 11, 1903.

Mr. C. H. Edwards, Clark Building, City:

Dear Sir: Referring to our recent discussion in connection

with the present adjustment of our rates on apples to points on our line in Northern Montana.

I beg to enclose herewith memorandum showing the rates from all producing points. In some cases, as I pointed out to you here, the through rates from the Bitter Root country are less than apply on apples from California, Oregon and Washington. This is true as to Great Falls and Benton, the two largest consumers.

I would be glad, however, to meet your committee at any time with a view to going over this matter in detail and to arrive, if possible, at some adjustment that would be satisfactory to you. As I stated to you verbally, it is not the intention of this Company to favor the consumption of foreign apples as against the Montana product, on the contrary, the short hauls at comparatively higher rates render us a greater profit.

Kindly get your committee together or as many as are interested in this and I will be glad to meet you any time, either in Butte or Helena.

Yours truly,
ARCHIBALD GRAY,
A. G. F. A.

At the conclusion of this correspondence the committee prepared a table of rates over all lines on the products under discussion and reported to the Society as follows:

Butte, Montana, January 19, 1904.

To the Officers and Members of the Montana Horticultural Society:

Your committee appointed at the last meeting of the Society, held at Stevensville, February 21st and 22nd. to investigate the matter of freight rates with a view to securing such reductions as might be deemed reasonable and just, report as follows:

Shortly after the adjournment of the meeting at Stevensville it was decided that Mr. Wooldridge should conduct negotiations with the Great Northern and Mr. C. C. Wills and Mr. Edwards with the Northern Pacific.

Your committee found on entering upon the work that it possessed no tangible information as to rates upon Montana products to the important markets of the State, nor rates upon like products to the same markets from competitive points west.

Recognizing the futility of attempting to secure any changes

in the existing rates without first securing reliable data from which to form a basis to work from, correspondence was entered into with all roads for the purpose of compiling a comparative schedule of rates.

Progress was necessarily slow in the matter. A great deal of correspondence was had which took up considerable time and at last it was discovered that if the schedule of rates was to be compiled that your committee would have to do it themselves. This was done and is herewith submitted as a part of this report, with all correspondence having any bearing upon the matter, for your consideration.

Wishing to be relieved of further duty in the work, we are yours respectfully,

C. C. WILLIS, Plains.
W. M. WOOLDRIDGE, Hinsdale.
C. H. EDWARDS, Butte.

FREIGHT RATES ON APPLES IN CAR LOADS, PER CWT., OVER NORTHERN PACIFIC RAILWAY.

FROM	To Butte.....	To Helena..	To Anaconda.	To Bozeman ..	To Livingston	To Big Timber	To Billings ..	To all points east of Billings and St. Paul ..
Grantsdale	$ .25	$ .25	$ .25	$ .45	$ .50	$ .60	$ .70	$ .75
Hamilton	.25	.25	.25	.45	.50	.60	.70	.75
Corvallis	.25	.25	.25	.45	.50	.60	.70	.75
Victor	.25	.25	.25	.45	.50	.60	.70	.75
Stevensville	.25	.25	.25	.45	.50	.60	.70	.75
Florence	.25	.25	.25	.45	.50	.60	.70	.75
Carlton	.25	.25	.25	.45	.50	.60	.70	.75
Lolo	.25	.25	.25	.45	.50	.60	.70	.75
Missoula	.25	.25	.25	.45	.50	.60	.70	.75
Plains	.30	.30	.30	.50	.55	.65	.70	.75
Thompson	.35	.35	.35	.55	.60	.70	.70	.75

NOTE—No rates are quoted on Potatoes, Vegetables, Hay and Grain to points east of Butte, Helena and Anaconda on N. P. Ry., as all eastern territory is supplied from Gallatin and the Yellowstone country. No rates are quoted on O. S. L. except to Butte, as said line does not enter other territory.

FREIGHT RATES ON APPLES IN CAR LOADS, PER CWT., OVER NORTHERN PACIFIC RAILWAY.

FROM	To Butte.....	To Helena....	To Anaconda.	To Bozeman..	To Livingston	To Big Timber	To Billings ...	To all points east of Billings to Dickinson ..
Grantsdale	$ .55	$ .55	$ .55	$ .93	$ .93	$ .93	$ .93	$ .93
Hamilton	.55	.55	.55	.93	.93	.93	.93	.93
Corvallis	.55	.55	.55	.93	.93	.93	.93	.93
Victor	.50	.50	.50	.93	.93	.93	.93	.93
Stevensville	.50	.50	.50	.93	.93	.93	.93	.93
Florence	.50	.50	.50	.93	.93	.93	.93	.93
Carlton	.50	.50	.50	.93	.93	.93	.93	.93
Lo Lo	.50	.50	.50	.93	.93	.93	.93	.93
Missoula	.42	.42	.42	.93	.93	.93	.93	.93
Plains	.60	.60	.60	.93	.93	.93	.93	.93
Thompson	.65	.65	.65	.93	.93	.93	.93	.93

FREIGHT RATES ON POTATOES PER CWT., CAR LOADS, OVER NORTHERN PACIFIC RAILWAY.

FROM	To Butte.....	To Helena	To Anaconda.
Grantsdale	$ .20	$ .20	$ .20
Hamilton	.20	.20	.20
Corvallis	.20	.20	.20
Victor	.20	.20	.20
Stevensville	.20	.20	.20
Florence	.20	.20	.19
Carlton	.20	.20	.18
Lo Lo	.19	.19	.18
Missoula	.18	.18	.17
Plains	.20	.20	.20
Thompson	.20½	.20½	.20½

FREIGHT RATES ON POTATOES PER CWT., CAR LOADS, OVER NORTHERN PACIFIC RAILWAY.

FROM	To Wallace Idaho	To Burke Idaho	To Wardner Idaho
Grantsdale	$ .18	$ .20	$ .20
Hamilton	.18	.20	.20
Corvalis	.18	.20	.20
Victor	.18	.20	.20
Stevensville	.18	.20	.20
McKeen	.18	.20	.20
Florence	.18	.20	.20
Carlton	.18	.20	.20
McLarrens	.18	.20	.20
Lo Lo	.18	.20	.20
Missoula	.18	.20	.20

FREIGHT RATES ON HAY PER CWT., IN CAR LOADS, OVER THE NORTHERN PACIFIC RAILWAY.

FROM	To Butte	To Helena	To Anaconda
Grantsdale	$.14	$.14	$.14
Hamilton	.14	.14	.14
Corvallis	.14	.14	.14
Victor	.14	.14	.14
Stevensville	.14	.14	.14
Florence	.14	.14	.14
Carlton	.14	.14	.14
McKeen	.14	.14	.14
McLarrens	.14	.14	.14
Lo Lo	.14	.14	.14
Missoula	.14	.14	.14
Frenchtown	.15	.15	.15
Plains	.17½	.17½	.17½
Thompson	.20	.20	.20

FREIGHT RATES ON HAY PER CWT., IN CAR LOADS, OVER THE NORTHERN PACIFIC RAILWAY.

FROM	To Wallace Idaho	To Burke Idaho	To Wardner Idaho
Grantsdale	$ .14	$ .16	$ .16
Hamilton	.14	.16	.16
Corvallis	.14	.16	.16
Victor	.14	.16	.16
Stevensville	.14	.16	.16
McKeen	.14	.16	.16
Florence	.14	.16	.16
Carlton	.14	.16	.16
McLarrens	.14	.16	.16
Lo Lo	.14	.16	.16
Missoula	.14	.15	.15

FREIGHT RATES ON GRAIN AND POTATOES MIXED IN CAR LOADS, PER CWT., OVER N. P. RY.

FROM	To Butte	To Helena	To Anaconda
Grantsdale	$ .23	$ .23	$ .22
Hamilton	.23	.23	.22
Corvallis	.22	.22	.21
Victor	.22	.22	.21
Stevensville	.21	.21	.20
McKeen	.20	.20	.19
Florence	.20	.20	.19
Carlton	.20	.20	.19
McLarrens	.19	.19	.18
Lo Lo	.19	.19	.19
Missoula	.18	.18	.17
Frenchtown	.18	.18	.18
Plains	.20	.20	.20
Thompson	.22½	.22½	.22½

FREIGHT RATES ON VEGETABLES STRAIGHT IN CAR LOADS AND MIXED VEGETABLES AND FRUITS IN CAR LOADS, PER CWT., OVER N. P. RY.

FROM	To Butte.....	To Helena....	To Anaconda.
All Bitter Root Points and Missoula	$ .25	$ .25	$ .25

FREIGHT RATES FROM WALLA WALLA, WASH.; LEWISTON, IDAHO; NORTH YAKIMA AND DAYTON, WASH., OVER N. P. RY., PER CWT.

ARTICLE	To Butte.....	To Helena....	To Anaconda.	To points east and including St. Paul .....
Vegetables (car loads)	$ .55	$ .55	$ .55	.....
Vegetables (less car loads)	1.30	1.30	1.30	.....
Apples (car loads)	.65	.65	.65	.75
Apples (less car loads).....	1.30	1.30	1.30	.....
Fruits straight (car loads)	.83½	.83½	.83½	1.12½
Fruits straight (less car loads)	1.30	1.30	1.30	.....

FREIGHT RATES FROM LEWISTON, IDAHO; NORTH YAKIMA AND DAYTON, WASH., ON POTATOES IN CAR LOADS, PER CWT., OVER N. P. RY.

ARTICLES	To Butte.....	To Helena....	To Anaconda.
Potatoes	$ .45	$ .45	$ .45

FREIGHT RATES OVER OREGON SHORT LINE IN CAR LOADS AND LESS CAR LOADS, PER CWT.

ARTICLE	Car Loads	Less Car Loads
Hay—From Blackfoot, Idaho, to Butte	$ .17½	.....
Grain—From Blackfoot, Idaho, to Butte	.20	.....
Potatoes—From Blackfoot, Idaho, to Butte	.20	.....
Vegetables—From Salt Lake Utah to Butte	.41	.....
Green Fruit—From Olds Ferry, Idaho to Butte	.83½	$1.25
Apples—From Spokane, Wash, to Butte	.65	.....
Apples—From Washington and Idaho to Points East of Butte to St. Paul	.....	.75

RATES ON APPLES FROM PRODUCING POINTS, IN CAR LOADS AND LESS THAN CAR LOADS.

TO	From Atlantic Seaboard P'nts		From California Points via Butte		From California Points via Spokane		From Snake R. Pts. in Wash., Idaho, Ore. via O.R.&N.&Sp.		From Wenatchee, Old Mission, Wash.		From Kalispell				From Missoula and Bitter Root Branch, N. P. via Helena			
	C.	L.	C.	L.	C.	L.	C.	L.	C.	L	C.	L.	L.	C. L.	C.	L.	L.	C. L.
Great Falls	$1.30		$1.18		$1.25		$ .65		$ .65		$ .52		$ .60		$ .57		$ .93	
Benton	1.30		.....		1.25		.65		.65		.62		.73		.63		.99	
Havre	1.30		.....		1.25		.65		.65		.53		.62		.73		1.11	
Chinook	1.30		.....		1.41		.75		.75		.55		.64		.75		1.14	
Harlem	1.30		.....		1.50		.75		.75		.58		.67		.78		1.17	
Malta	1.30		.....		1.61		.75		.75		.64		.74		.83		1.22	
Shelby Junction	1.30		.....		1.25		.65		.65		.40		.46		.69		1.07	

These rates were in effect up to May 1st, 1903.

July 3rd the following notice was mailed to all Inspectors:

Butte, Montana, July 3, 1903.

Dear Sir: By the direction of the President of the Montana State Board of Horticulture, you are hereby notified that a meeting of the Inspectors of said board will be held in the city of Butte, July 9, 1903, at 2 p. m., in room 104, Clark Block. corner Park and Academy streets.

The purpose of the meeting is for an exchange of opinion on orchard and fruit inspection and such other matter as may come before the meeting and to secure united action among the Inspectors.

You will try and be present. Bring with you any specimens of diseased fruits or nursery stock that you may have or be able to secure. You will take vouchers for all money expended in attendance upon this meeting. Kindly reply at once informing me whether you will attend. It is important, so be sure and be here on time. Yours truly,

C. H. EDWARDS, Sec.

July 9th Inspectors met and the following is a record of the session:

In accordance with a resolution passed by the Board at its meeting in April, authorizing the Inspector at large to call together the Inspectors, that they might discuss questions pertaining to the work of inspection, notice was sent to all Inspectors to meet in Butte on July 9, 1903.

In response to this notice there were present: E. N. Brandegee, Helena; H. C. Gardiner, Bozeman; C. E. Hubbard, Great Falls; Henry Whit, Billings; Geo. S. Good, Thompson; E. M. Tucker, Missoula; J. O. Read, Hamilton, and C. H. Edwards, Butte.

Meeting was called to order by C. H. Edwards. It was moved and seconded that Mr. Brandegee occupy the chair. Carried.

Moved and seconded that Mr. Gardiner act as secretary. Carried.

C. H. Edwards read the call and stated the object of the meeting. A communication from Mr. Pace, of Helena, relative to cooperation of Fruit Inspectors with officers of State Fair in securing an exhibit of apparatus used in fighting pests, and also suggesting a list for exhibition, was presented.

Moved that the matter of arranging premium list for fruits be referred to Mr. Harlan.

Moved by Mr. Reed that Mr. Edwards take up the matter of securing spraying apparatus with manufacturers for an exhibit. Carried.

Moved by Mr. Edwards that Mr. Brandegee gather together diseased specimens of nursery stock and fruits for exhibition at the State Fair, and also that he have co-operation of the Fruit Inspectors.

Moved by Mr. Hubbard that the Inspectors co-operate with the State Fair authorities in securing an exhibit for the State Fair and, if possible, securing an exhibit for the County Fair. Carried.

Resolved: That it is the sense of the meeting that 250 jars would be the number required for the preserved exhibit for the World's Fair, subject to the wishes of the Fair authorities.

Moved by Mr. Edwards that this meeting endorse Mr. Gardiner's action relative to the condemnation of Mr. Williams' fruit in Bozeman, and further, that the secretary of the Board acquaint Mr. Williams with this fact. Carried.

Mr. Hubbard said that Mr. Lowery, of Great Falls, Lindsay & Co.'s representative, wished to convey to the meeting his appreciation of the services and work of the fruit inspection in the State.

Resolved; That where an Inspector, upon examination of any orchard or garden, finds it necessary that the trees or plants therein need treatment for any disease that the owner be notified as per Section 11, of the law, to proceed to eradicate said diseases and if after a reasonable time the owner fail to comply with the instructions given, that the Inspector proceed to do the work and charge and collect from the onwer the cost of such work. That it is the opinion of Inspectors that it is not wise upon the part of the Board to perform the work of spraying or treating diseased orchards or gardens. That it would be better to have owners understand that they must, themselves, do the work as stated in Section 11, of the law.

Moved by Mr. Edwards that it is the sense of this meeting that the Inspectors gather and destroy all fruit packages and bill the expense as usual. Carried.

Specimens of San Jose Scale, roots affected with Woolly Aphis and Crown Gall, were exhibited.

The meeting discussed the various methods of orchard and fruit inspection and exchanged ideas on all the work, and adjourned after holding two sessions, feeling that much good was experienced through interchange of ideas.

H. C. GARDINER,
Secretary.

Exhibit at Ogden.

During the meeting of the Irrigation Congress, held in Ogden, Utah, in the fall of 1903, in response to a number of urgent requests from the officers of the Irrigation Congress to attend and make an exhibit of fruit, the work was undertaken and a small exhibit, containing 125 plates of some of our choice fruits, was prepared and taken to Ogden for exhibit at the County Fair, which was held during the session of the Congress. The exhibit, while small, was very choice, and formed a very interesting part of the fair. In addition to the very magnificent display of fruits made by Utah and Idaho, Wyoming, Colorado, California, Oregon, Washington and Montana contributed very creditable exhibits. The Montana exhibit created the greatest interest among visitors, as it was not generally known that our State was adapted to the culture of fruits.

FRUITS INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1903.

	Boxes.
Apples	126,406
Pears	10,028
Plums and Prunes	25,100
Peaches and Apricots	48,532
Cherries	8,356
Quinces	43
Oranges	29,249
Lemons	11,518
Total	* 259,232

* Of this amount there was inspected in Butte City alone 191,624 packages.

FRUITS CONDEMNED IN STATE FOR YEAR ENDING NOV. 30, 1903.

	Boxes.
Apples (For Codling Moth)	695
Pears (For Codling Moth)	442
Peaches (For Peach Worm)	800
Total	1,937

In addition several car loads of apples were sent out of the State as unfit for market.

FRUIT TREES, PLANTS, ETC., INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1903.

Apple Trees	167,050	
Crab Apple Trees	5,252	
Plum and Prune Trees	23,389	
Cherry Trees	21,780	
Pear Trees	22,563	
Quince Trees	780	
Peach Trees	631	
Apricot Trees	209	
		241,654
Shade Trees	36,933	
Ornamental Trees and Shrubs	11,293	
		48,226
Blackberries	10,671	
Raspberries	23,250	
Currants	8,894	
Gooseberries	11,342	
Grapes	13,512	
Strawberry	100,636	
Rhubarb and Asparagus	3,016	171,321
Total	461,201	461,201

In addition to above, 610 packages of mixed stock were inspected.

NURSERIES INSPECTED FOR THE YEAR ENDING NOV. 30, 1903.

Number of Acres	62
Number of Small Plants	24,000
Number of Trees	585,000
Number of Trees Condemned and Destroyed	2,973
Disease Condemned for	Grown Gall

DISBURSEMENTS "APPROPRIATION FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1903.

RECEIPTS.

Appropriation, 1903	$3,500.00

DISBURSEMENTS.

General Expenses—		
Printing and Engraving	$366.64	
Services and Expenses Inspector at Large	289.00	
First District—		
Inspector's Service and Expenses	$27.30	
Second District—		
Inspector's Service and Expense	$41.90	
Third District—		
Expenses Board Member	$ 26.95	
Inspector's Service and Expense	192.45	
Supplies	11.80	
Fourth District—		
Expense Board Member	$ 56.80	
Supplies	135.31	
Inspector's Service and Expense	933.60	
Fifth District—		
Inspectors Service and Expense	$332.60	
Sixth District—		
Expense Board Member	$ 32.60	
Supplies	14.95	
Inspector's Service and Expense	163.25	
To Balance	874.85	
	$3,500.00	$3,500.00

RECEIPTS AND DISBURSEMENTS "FEE FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1903.

RECEIPTS.

Balance on Hand December 1, 1903	$ 91.82	
Fruit Trees	2,417.24	
Nursery Stock	320.75	
Orchard Work	270.22	
Licenses	350.00	
Rent	60.00	
Total		$3,510.03

DISBURSEMENTS.

Wages	$2,163.58	
Freight, Expressage and Transfer	87.03	
Rent and Supplies	639.39	
Traveling Expense	234.85	
Telegraph, Telephone and Postage	215.00	
Balance on Hand Nov. 30, 1903	170.18	
	$3,510.03	$3,510.03

During the year 1903 there were 79 notices of shipments of nursery stock received; fourteen licenses issued to nurseries; ninety-seven salesman's certificates made out; ninety-two inspector's reports received; 1,139 letters were answered, 500 circulars were mailed out; 3,000 copies of the Board report, and 1,000 copies of the horticultural law were distributed.

Helena, Montana, January 8, 1904

To the State Board of Horticulture:

Gentlemen: As Inspector at Large it has been my duty to visit the various portions of the state, consult with other Inspectors, determine the different plant diseases and insects submitted to me, and give the best methods of treatment. The state is very large and I found it difficult with the amount of time that could be spared from other duties, to visit all parts of it. The Bitter Root Valley is the most important horticultural valley and naturally has claimed its share of attention. Next year, however, I expect to devote more time to Board matters.

Nursery Stock Inspection.

Of all the duties of the Board that of nursery stock inspection is the chief at the present time, and is likely to continue so until a radical improvement in the trees offered for sale is manifest. I refer not only to trees shipped into this state, but also to trees of our own nurseries. An inspection and supervision of these will save the planting of diseased stock and the large subsequent

loss that has occurred in many instances within this State in years past on that account.

Local nurseries in common with nurseries of all other States distribute freely apple aphis, which occurs now in all apple growing sections of the State. As this insect is in the egg for ordinarily at the time of transplantation from the nursery and the egg is impervious to chemicals no method can be suggested that will stop the transfer of this insect to even new localities.

Aside from this aphis local nurseries distribute almost no other insect, and certainly no especially injurious one. They are free from Woolly Aphis and all scale insects. But in common with many nurseries East and West, the products of some of them are infested with Crown Gall, tan which no more serious fruit pest is known in Montana at the present time.

Crown Gall I believe to be a disease of comparatively recent introduction. So persistent and destructive a pest would have received attention earlier if it had been present over any large extent of the country. It is not until very recently (1900) that its dangerous character has been manifest. Its first inrtoduction to Montana is probably within the last ten years. What it has done on a small scale and as an instance of the destructiveness that it may attain in the larger field of the entire State, I quote the following letter:

September, 29, 1903.

My Dear Sir: You no doubt remember that I am interested in a young apple orchard at Victor, Montana. This was set out four years ago last Spring in part, and the balance one year later. We have replanted over 3,300 of the original 7,000 and I have concluded a careful examination this Fall and find to my sorrow that about 1,000 more trees are dying and probably one-half of the entire lot are diseased or at least not making the growth they should.

Mr. J. O. Read kindly looked over the situation while I was there and says that the trees are infested with Crown Gall, which to me is a new disease and which I do not find mentioned under that name in the few books upon the subject which I am able to get hold of.

Whatever the character of the disease is, it is there and has cost us many thousand dollars' damage and the full extent of it I do not as yet know. I am very anxious to get all the information possible, and to learn if anything can be done to stop the ravages, also if it can be communicated in the orchard to new

and healthy trees; also how close to the spot occupied by the old tree would it be safe to plant the new tree with which to replace it.

I feel certain that you will afford me all the information you can find concerning this most discouraging situation so that we can form some idea what is the best course for us to pursue. I do not like to give up as the orchard has cost over $5,000 to date, besides the cost of the land and the loss of the use thereof.

Thanking you in advance for whatever you can do for me, I am, yours very truly, _____

I cannot too highly recommend Mr. J. O. Read and his faithful work as inspector under the Board. It was he who made the first condemnation for Crown Gall within the state and ten thousand trees were burned for this cause alone at one time on the authority of his observations of the disease in the Bitter Root Valley. His observations were correct in every particular and that condemnation and subsequent ones have saved tens of thousands of dollars to horticultural interests in the State of Montana.

Crown Gall is a destructive and highly contagious disease. It affects apple, pear, plum, cherry, quince, apricot, peach, poplar, blackberry and raspberry. The disease is caused by a slime mould fungus. The spores of this fungus travel easily in the nursery row and a nursery may become quickly thoroughly contaminated when the disease is once introduced into it.

No method of eradication is known. The tree or trees infected should be burned. This applies to nursery stock and to trees in the orchard. No tree should be planted on the same spot where a previous tree has died from Crown Gall, as the germ of the disease persists for about four years in the soil. The practice of growing nursery stock on the same ground year after year cannot be pursued after the germ is once introduced into the nursery.

All Inspectors of the Board should be constantly on the watch for Crown Gall on nursery stock offered for sale. All infested trees should be burned and if a shipment of stock shows galls on one-half of the trees the entire shipment should be destroyed.

As the disease is widespread and affects many nurseries throughout the country and some of our local nurseries, the only method to pursue is to destroy nursery stock when found infected. The presence of any Crown Gall in a shipment of nurs-

ery stock subjects the remainder, although no galls can be found on the roots to grave suspicion.

Black Knot.

In the Gallatin Canyon and in Rattlesnake Valley, on Prunus demissa, I have found the Black Knot of the plum and cherry, Plowrightia morbosa, Sacc. It is native in both these regions and doubtless can be found in many other moist canyons East and West of the divide on the wild cherry. This disease may prove troublesome to cultivated cherries and plums in the Rattlesnake and elsewhere.

The disease may be best known by unsightly black knots near the end of branches of plum and cherry trees. It is a serious pest, but may prove less destructive in the dryer climate of Montana.

Woolly Aphis.

Woolly Aphis occurs on one old tree in the city of Missoula. It is not often met with on nursery stock shipped into the State, Now and then it appears and Inspectors always destroy the infected tree.

Codling Moth.

I have found Codling Moth at Missoula, Helena, Thompson Falls and Kalispell. Other Inspectors may, in their own districts, be able to add to the list of infected localities. It was reported to me that it had appeared at Carleton and I made a visit to the orchard reported to be infested. The moth was not to be found there and had never been found there. The erroneous statement to that effect was due to a mistaken idea that arose in the course of conversation between two people in that neighborhood.

While the moth is liable to be found anywhere that apples are raised along the line of railroads, too much reliance on unconfirmed reports of its occurrence should not be placed. Other insects and also birds make holes in apples in Montana. The moth makes a typical hole in an apple, but the identification of the insect from this evidence should be left to an expert.

In Missoula extensive work was done this year against the Codling Moth, but not as much as during the year previous. One spray of Paris green and lime was applied to apple and pear trees in the town and a system of banding was diligently pursued.

The moth was in evidence as much as last year owing probably not to greater abundance, but to the smaller crop of apples.

It is not feasible to even hold down the moth in a district so infested as Missoula without sufficient funds to spray at least three times. Spraying with Paris green and lime is the most effective way of dealing with this insect and I believe that the money spent in banding trees could be more effectively spent in spraying them. I therefore recommend that three sprays at least be applied for this insect in Missoula this year and that the banding be eliminated.

While the complete eradication of a noxious insect is much to be desired as a matter of fact complete eradication is hardly feasible and where the infestation is great and the area large, practically impossible. Especially is this the case with Codling Moth, fortified so securely by its methods of life. Paris green will kill the insect, and to raise apples profitably in an infested district is possible by its use. But to exterminate the insect in a city with as many and as large trees as are in Missoula with the weapons at present known I regard as an impossibility.

And even if extermination could be accomplished, in a very short time, reinfestation and reinfection would take place from the railroad cars that pass through the town.

The problem then of the Codling Moth in the railroad centers of the State where apple trees are grown seems a perennial one. The work for the Board is one of repression of the pest at these points as much as possible and the prevention of its spread from these centers and by primary infection from other States. The spraying and banding done in Missoula and elsewhere, and the general inspection of fruit cannot but be very efficacious in preventing this dissemination, or at least in delaying it very much.

In the Kalispell infestation different conditions are encountered. The trees there are all young and the number of moths is at present small. The work done there the past season has at least stopped the increase of the infestation. I recommend that at Kalispell for the next year that special effort be made to decrease the number of moths to a minimum and to pursue the work in future years to see if it is possible to exterminate the moth on even a small field. Little extra expense would be involved. Large orchards are threatened in that vicinity and in-

vasion of these would be delayed at least for a long time. And the work will be of an experimental kind, the results of which will be indicative of plans for the future treatment of this pest.

The horticultural area is extending rapidly in the state and the appropriation for our work shows no such increase. The Board has ever found its funds inadequate and must sooner or later pursue the plan of ordering the owners of orchards that are infested with pests liable to spread and become a general nuisance, to repress them or to do it ourselves at the expense of the person most interested. In repressive work in cities this plan has been tried and found to be a poor one. Too much friction was encountered and the cost of collection left so little returns that it was abandoned. But in commercial orchards this plan must in the future be pursued.

Codling Moth first establishes itself in the orchards of the principal towns. The intercourse of these with the country district is closest and they become distributing centers of this insect. The number of fruit trees in towns is economically small, but their influence on the spread of insects is very great. It would have delayed the coming of the Codling Moth twenty years if no apple or pear trees had been to grow within the limits of incorporated cities.

Aphis of all kinds have been less abundant than in previous years, due to the cold spell in June and to an increase of parasitic enemies. The first was a condition that prevailed over the entire State; the second was manifest in districts and most evident in the city of Helena, where lady bugs were in such abundance as to hold the box elder aphis in check and stop three-fourths of its ravages.

Lime sulphur and salt is very effective in destroying the eggs of aphis and is a spray that is destined to be extensively employed in Montana. Pear leaf blister mite, red spider, oyster shell bark lose and, indeed, scale insects of all kinds are held in check by its use. Mr. O. C. Estey of Flathead County, reports favorably of its use against oyster shell bark louse in his district, and Mr. Goode, of Thompson, corroborates his statements from practical work at Plains.

There are patches of this scale insect through this State that

should be treated with this spray and I recommend its use upon them during the dormant period of the trees this winter.

San Jose Scale has not to my knowledge yet been found in Montana and, perhaps, if found will not prove as serious a pest as oyster shell bark louse. The latter is well adapted to our climatic conditions passing the winter in the egg form. Prof. Elrod and myself, however, have brought to light a scale insect in Missoula which has much the same life history as the San Jose Scale. Dr. L. O. Howard identifies it with Aspidiotus populi, a new species recently found at Sand Point, Idaho, and at Ogden, Utah. The insect was probably brought to Montana on nursery stock imported from Salt Lake. It closely resembles San Jose Scale and also Aspidiotus ancylus. Poplar trees of different kinds are infested by it. In Missoula it is found on Carolina poplar. The trunks seem the favorite habitat, though limbs are sometimes infested. The bark become rough and warty and finally twisted and knarled. While no trees are to be found in Missoula that have been killed by the insect, some are to be seen in the last stages of life. Bark on older trees is too thick for the insect to do much damage, but on the younger trees the injury done by them is very great.

I have found it necessary to condemn a large shipment of roses for greenhouse affected with root nemotodes. The pest is a most serious one of roses and affects also a large number of other greenhouse plants. That so many greenhouses are free from them is remarkable. At present I know but two greenhouses in the state affected by them. In one of these the advice of the Board of Horticulture has been followed and sterilization of soil has been resorted to. This is an expensive process, but I believe that the returns from roses planted in soil thus prepared have demonstrated that the proceedure is very profitable. No trace of nematodes can be found in roots and the bushes are probably healthier in other ways than when grown in unsterlized soil.

E. N. BRANDEGEE,
Inspector at Large.

Hamilton, Montana, February 8, 1904.

To the Montana State Board of Horticulture:

Gentlemen: During the past season I have inspected 142 orchards and home gardens. All these orchards are located in

and around Grantsdale, Hamilton, Corvallis, Victor and Stevensville. I also inspected all the orchards along the railway in the district, realizing that if there was any diseases to be found that I should be more apt to find them in these orchards than in those situated farther in the country. It is a well known fact that insect pests are very apt to originate in orchards near towns and railroads. This is especially true as regarding Codling Moth.

The Codling Moth is no doubt one of the worst enemies that the orchardist has to contend with, and for this reason I made a most careful search for this pest in the district. I found the moth present in an orchard in Hamilton and from what I have been able to learn it has been there for some time.

All of the older orchards and most of those set out later years are in good condition. There are, however, a few of the younger orchards infected with Crown Gall. According to my observations the Crown Gall is the most dangerous disease that we have, affecting trees. The disease not only kills the trees affected. but leaves the soil in which the trees were planted in unfit for orchard use for a long time, at least until it has been cultivated to some other crop than trees for several years. The only way of riding the orchard of this disease is to pull up all infected trees and burn them, and then crop the land to some leguminous plant.

I find that the Crown Gall has been in the district for several years and it has cost the orchardist much time and money. The utmost care must be used to prohibit nursery stock from being planted that is affected with this disease. I might say that there is now one orchard which is so thoroughly infected with Crown Gall that the orchard is almost a failure. Of course the owners will, in time, by a proper system eradicate the trouble, but it will be at a great cost.

Until recently the Eastern nurseries have used Montana as a dumping ground for all their worthless and diseased stock and it is not surprising to find after years of labor and waiting that many of our trees are worthless. Of course this is not so any longer. Our law has caused them to look carefully after the quality of the nursery stock sent in, yet only the utmost effort of the growers with the Board will avail us if we intend to keep our orchards free from many of the troubles that our neighbors

in other States have to battle with. In this connection I would impress upon the minds of every fruit grower the necessity of examining all trees and plants, even though they have been inspected by the Board. Should any of the stock intended for planting be found to show signs of any disease the Board member or Inspector should be called to examine same. Better wait a day or two than to plant and then find that you have spent your time and money on worthless stock. It must be remembered that with the thousands upon thousands of trees and plants coming into our State annually that it is possible for some diseased stock to escape. The Board is doing all that lies within its power to prevent the importation of any diseased stock, but at the same time the utmost vigilance of every planter is necessary in the fight against diseased nursery stock.

I find that many trees are injured by sunscald. This is due to climatic conditions and can be prevented in a great measure by painting the trees with some good tree paint. There are many of them on the market. A good coating of white wash will be found effective. I have observed that where either tree paint or white wash has been used that the injury from sunscald has been much less.

So far I have not discovered the oyster shell bark louse in the district. It is not a serious disease; it can readily be eradicated in one season by the use of lime, sulphur and salt solution, which has been proven by the Board in its work where this pest has been in evidence for many years.

To those who are contemplating the planting of orchards I would suggest that they write the Secretary of the Board for information as to varieties that are best adapted to our climate, and for commercial orchards. The McIntosh apple as an early winter apple cannot be surpassed. It can be grown to perfection in this country and will prove a good apple for commercial orchards. The fruit growers of Montana must make up their minds to get down to about three or four good varieties, and where possible, two varieties would be better. It is my experience both from practical work and observation that all small fruits, such as currants, gooseberries, blackberries, raspberries and strawberries succeed very well and are all money makers. One can get through their culture some ready money while wait-

Sectional View Montana Horticultural Exhibit, World's Fair, St. Louis, 1904.

Sectional View Montana Horticultural Exhibit, World's Fair, St. Louis, 1904.

ing for the tree fruits to bear. From three to five hundred dollars per acre may be secured from small fruits when properly cultivated.

I cannot close this brief report without calling the attention of all growers to the necessity of carefully preparing their products for market. I have observed throughout my travels that there is a tendency among many of the growers to overlook this important point; to think that with the successful growing of their product that their work ends. This is wrong and if we are to gain a reputaiton for our orchard and garden products we must see that strict attention is given to the work of preparing our goods for the market. Indeed I might say that there is more in the manner in which our products are packed than in the quality of the goods themselves. Respectfully submitted,

J. O. READ,
Member for the Fifth District.

Butte, Montana, January 11, 1904.

To the Honorable State Board of Horticulture:

Gentlemen: As Inspector in the Fourth District, I have the honor of submitting to you the following report of the past season's work done by me.

During the year I have inspected 5,238 packages of fruit as follows: Apples 256, apricots 155, cherries 205, oranges 5, pears 339, peaches 3,589, plums 636, quinces 53; of these I found it necessary to condemn 117 packages as follows: Apples 35, pears 82. I also inspected eight cars of oranges and lemons.

The fruit which came to Missoula from the West is consigned to this place from Walla Walla, Prosser, North Yakima and Lewiston. The early pears and apples from these points were, as a rule, badly affected with Codling Moth. After a few lots were condemned only good fruit came, the consignors ceased shipping to Missoula, owing to their fruit being so badly infested with the moth. They doubtless sent it to other states having no inspection laws. The cherries, apricots, plums, peaches, oranges and lemons were very good. The later varieties of pears and apples were also free from diseases or pests. During the heavy fruit shipping season I visited the depot, express office, fruit stores and warehouses twice every day. While the season was so heavy I procured a dray and hauled all second hand boxes to

the city dump, where I burnt them. I accompanied each load to be sure that they were always destroyed. Everything possible was done to enforce the law in regard to the destruction of second hand boxes. I informed the merchants and growers that the Horticultural Board on this point were very particular and that the Board fully intended to enforce the law. I had much less trouble with the second hand boxes than I had anticipated.

Orchard Work.

Last year we sprayed twice in Missoula for the Codling Moth. But when the time came this year to put on the first spray Mr. Brandegee and I looked over the ground and saw that so much of the fruit was falling, and came to the conclusion that it would be useless to spray. Besides the weather was so changeable it would have been almost, if not, impossible to spray at that time. In July all of the worst infested apple and pear trees were banded, the number of trees banded was: Apples 2,163, pears 141. Some trees required from one to two bands, while others required as many as twenty or more. The total number of bands put on was 5,006. I commenced putting the bands on July 28th, and finished August 17th. By that time, which was two weeks later than last year, a spray was put on. The spraying was commenced August 18th, and lasted until August 31st. The number of trees sprayed was 5,286; the number of homes where spraying was done was 342.

When the larvae began to leave the fruit the bands were examined closely and the larvae were taken frim them and placed in a tin of coal oil, where they lived but a short time. The bands were watched closely throughout the entire season.

As far as I have been able to determine, the banding system and spraying are the only methods in use that can be depended upon. An early and thorough spraying is worth more than everything else that can be done.

I made several trips into the country to see if the moth was making its way into those parts, but could not find any signs of the fellow there. It does not seem to be spreading to any great extent in the city, where it has been for some years. It inclines to stay in the old orchards. I got word that the pest was in an orchard at Carlton; I notified Mr. Brandegee, who came at once to Missoula; we lost no time in getting where it was reported to be; the moth was not to be found.

Last Spring and Fall I fumigated and inspected 32 lots of nursery stock; this stock was consigned from 26 different nurseries. In some instances the stock was infested with Woolly Aphis, and Crown Gall. In one or two instances the stock was infested with both of the diseases. In such instances the entire shipments were destroyed by burning. Wherever any diseases were present I always sorted the lot over personally and destroyed the infected ones.

By this time the Eastern nurserymen have doubtless begun to know that they can no longer use Montana as a dumping ground on which to place their inferior and diseased stock. Nursery stock inspection is one of the most important duties with which the Board has to deal.

At the beginning of the packing season last Spring, Mr. Brandegee and myself visited the local nurseries. While they were packing I made frequent visits to see that the horticultural laws were being obeyed. I found not only the local nurserymen, but also the nurserymen beyond our state only too glad to comply with the law. The people of Missoula are beginning to see that they cannot grow fruit without protection from encroaching pests.

Last year's work was certainly productive of much good. The work went along very smoothly in this District. I am greatly indebted to those who helped to make the work pleasant as well as profitable—to Mr. Charles H. Edwards, to Mr. E. N. Brandegee, and to Mr. C. C. Willis. Respectfully submitted,

E. M. TUCKER,

Missoula. Inspector.

Thompson, Montana, December 29 1903.

Mr. President and Members of the State Board of Horticulture:

I have the honor to present my annual report as Inspector of the Fourth District.

I have inspected 69 orchards, a total of 18,038 trees; 16,178 apple trees, 722 pear, 658 plum, 436 cherry, 43 peach, 17 apricot, 5 nectraine and 4 quince trees and twenty and three-fourths acres of small fruit, including some very fine grape vine.

I found most of the orchards in very good condition, but I found some that looked as if they were set out and supposed to

grow and bear fruit with no further care, and of course you all know the results.

I found some very serious pests, at Thompson twelve and at Heron three small orchards, with a total of six hundred trees, very badly affected with Codlin Moth.

I found one orchard at Plains, and one at Selish, badly affected with oyster shell bark louse. In the orchards of Mr. Isaac Sears and Mr. Pierce, that had been sprayed with lime, sulphur and salt for the oyster shell bark louse, the insect was thoroughly eradicated, and I believe the same spray to be very good for pear leaf blister mite and apple scab, of which I found some.

For the Codling Moth I sprayed with Paris green and lime, one pound of each to one hundred gallons of water, the first of July, but should have sprayed about the 20th of June, but did not get the outfit sooner. I also bandaged the trees with strips of burlap and changed them once a week and I found as high as fifteen worms under one band; also picked all the fruit that showed any signs of moth and destroyed it once a week.

I found considerable pear leaf blister mite, also some Flathead apple tree borers and some plum curculio; also some apple tree anthracnose and canker.

I also found a great many trees affected with black heart, but found most of the orchards in very good condition, and some very fine orchards and some very fine fruit, of which Mr. Thomas Wilson, two miles East of Paradise, had the finest apples, and they certainly were fine.

At Paradise I found quite a number of apricots and peach trees loaded with fruit, and believe it a good locality to raise them in larger quantities.

Grape vines are growing on the ranch of Mr. Fred Vaughn, one mile West of Eddy, loaded with large grapes of the Concord variety.

The best trees and the best fruit I found on the clean, cultivated orchards, the next best on orchards crop such as garden, potatoes, etc., but would not recommend an orchard being seeded down to grass of any kind.

I wish to thank Mr. Brandegee, President, and Mr. Edwards, Secretary, for their kind instructions and assistance on several occasions. I am, yours truly,

GEO. S. GOOD,
Inspector Fourth District.

Great Falls, Mont., Dec. 15, 1903.

C. H. Edwards, Esq., Secretary State Board of Horticulture, Butte, Montana:

Dear Sir: In making my report as Inspector for the Third District for the year from November 30th, 1902, to November 30th, 1903, I wish to touch briefly upon the work which has been done here this year.

I have inspected and passed 51,711 packages of fruit. I have inspected and fumigated 115 packages of nursery stock, which has been received here from outside of the State. Also have made two nursery inspections. Owing to the fine conditions which the fruit trees we have in this District are in and as I made a careful inspection of them last year, did not deem it advisable to put the State Board to tne expense of inspecting the same this vear. I am glad to say that fruit has been coming so nice this year that I have not had to condemn a single package, and I think the shippers realize that Montana is no longer their dumping ground. The first part of the season I wrote several letters to the shippers cautioning them against sending infected fruit, and I understand they are expending a large sum of money in exterminating the fruit pests from their orchards. .

Although we still have one man here, who I do not think the inspection law effects at all, but who deems it his duty to kick about some parts of same, I hear a great many speak very highly of the good which the inspection law has done for this part of the State.

The Inspectors' meeting, which was held at Butte in July of this year, I think was a great help to all of us and enables us to work along the same line.

I was called out in the country last spring by a man who thought he had the San Jose scale on his young apple trees, but found it to be only the eggs of the apple aphis, which for some reason had not hatched.

The elm trees along our boulevards were not nearly as badly infected this year as they were a year ago by the elm aphis, and I think perhaps we can lay this to the late frost which we had in the spring, which without doubt killed a large portion of them.

I have been unable to find any crown gall in this locality as yet, but think we should keep up a very rigid inspection against

this, as it is without doubt one of the worst enemies which we have to contend with.

Very respectfully,
C. E. HUBBARD,
Inspector Third District.

Bozeman, Mont., Jan. 16, 1904.

To the Honorable State Board of Horticulture.

Gentlemen: Gallatin valley is not yet a fruit-growing section of the State, but judging from the number of orchards that are being set out yearly, it will be one not many years hence. It is important, therefore, that the young trees and consequently the old ones, be kept free from insect pests. On account of this lack of the home-grown product almost all of the fruit has to be shipped in, one kind and variety of fruit coming from Idaho, another from Washington and still another from California, and these kind of fruits bring into this State the insects which thrive in those localities. It is certainly very important, then, that an inspector be stationed at this place as a protecting agent to both the farmer and merchant. In this connection I would like to call the attention of the Board to a fact which has in this valley to a degree, at least, destroyed the efficiency of the horticultural law. Bozeman has an inspector, but its neighboring towns have not. As a result of this, poor qualities of fruit will be consigned to the towns where no inspector is situated and will be sold at a much lower price than fruit which has to pass inspection.

The consumers of fruit in and near Bozeman, thinking rather of price than quality, will drive to these towns and buy their apples and whatever other kind of fruit they are in need of. This as I said before defeats to a certain extent the purpose for which the horticultural law was created.

During the past fiscal year 7,590 packages of fruit have passed through the inspector's hands at Bozeman. These packages were in 17 different lots, 12 of which were car lots, and consisted mostly of apples. Out of this number 296 packages were condemned because of being infected with codling moth.

Very respectfully,
FRANK H. HAM.

Big Fork, Mont., Dec. 15, 1903.

Mr. President and Members of Montana State Board of Horticulture.

Gentlemen: I have the honor of submitting to you my third annual report as inspector of orchards for the Fifth Horticultural District of Montana. It is with pleasure that I can report a bountiful crop of all kinds of fruit in this district, and of a superior grade generally, although some was rather small, when not thinned properly. But as a general thing the fruit growers are alive and up to date in horticulture. Prices have ruled good and fruit of superior quality has sold at good prices for cash.

Buyers of fruit demand it of good quality, well graded and packed in attractive packages.

A great improvement is noticeable in the way growers are placing fruit on the market; a large amount of it has been shipped from Kalispell the past season, first-class fruit bringing fancy prices. But there is still room for a great improvement in grading and packing fruit for shipment. The tendency of some to try to make the good sell the poor, which causes all to be graded as poor, is a very poor business proposition.

During July the fruit growers of this district organized an association for mutual benefit. (It was too late in the season for berry growers to receive any benefit this season.)

Arrangements were made to have a business house in Kalispell handle the balance of the fruit crop. It was only partially successful, as business rivalry between commercial houses caused some loss to our home market, as some fruit was shipped in which caused ours to find an outside market, which may prove "a blessing in disguise," as a demand has been created for our fruit in other places.

The association proposes to place an independent factor in charge of their fruit the coming season. Also secure fruit packages as an association, which should be a saving to individual members.

Owing to other important duties I could not give orchard inspection the attention it should have, considering the importance of the subject. However, have made a few notes which may be of value to the Board.

The codling moth being the most destructive, will consider it first. From what I have seen of its work in Kalispell I think that the past season was the third of its existence, and it is

spreading fast. Where there was only three orchards reported in 1902, there was twenty-two in 1903. In one orchard where there was only five trees affected in 1902, in 1903 there was fifty-nine, with 715 wormy apples found and a number of the larvae destroyed by the owner of the orchard, of which no record was kept.

The plan followed the past season was to thin the apples close, pick and destroy all wormy fruit, band the trees and examine bands every ten days.

August 8th some apples were found from which the larvae had escaped; on the 11th of August the first cocoons were found. On the 3d of October the last larvae were discovered. Number of orchards infected, 22; number of trees, 180; per cent of trees infested, 32 per cent; per cent of apples affected on trees infested, 15-16 of one per cent.

At picking time very few apples were discovered containing worms.

Unfortunately no record was kept of work done by deputy, although positive instructions were given to that effect.

September 3d three trees were discovered with wormy apples in Lakins' orchard at Big Fork. All the apples from the affected trees were burned; however, most of the larvae were gone from the apple. The coocoons were undoubtedly carried to the orchard in using second-hand boxes. Wormy apples were reported from Columbia Falls, Swan Lake and west side of Flathead lake, but were not verified. Codling moth was found on one pear tree in Kalispell.

The spraying outfit was received too late in the season (July 15th) to derive much benefit from as yet.

There was an article in a local paper which criticized the inspector for not taking bands off trees every five days, and was accused of lack of diligence for not doing so. The writer had not informed himself of the habits and life cycle of moth before writing the article and there are many who do not take the time to enquire into it, so it may be as well to quote some authority on the moth. C. B. Simpson, special field agent for the Department of Agriculture, in Bulletin No. 41, gives the time as twenty-two days from the time the moth enters the band to emergency, and quotes Prof. Gillette, of Colorado, as placing the period at a minimum of twelve days and a maximum of twenty-nine days, with an average of twenty days. Riley,

from fifteen to twenty-one days; Washburn, three weeks; Slingerland, two to three weeks. Perhaps it would be advisable for the Board to issue a pamphlet descriptive of the codling moth, giving all information as to its habits, life cycle, etc.; also remedies to exterminate. Any information which would be useful to orchardists and the general public, as a lamentable lack of knowledge exists on the subject, and as it has gained a foothold here, every fruit grower should know how to treat the codling moth.

I burned one load of second-hand boxes last season, which were sold by a merchant handling fruit. I shall push that section of the bill next season. On the 17th of March, 1903, I sprayed an orchard with lime sulphur and salt solution to destroy oyster shell bark louse, using 15 pounds of each to 40 gallons of water, boiling lime and sulphur one hour, adding salt and boiling 15 minutes longer, and applied it hot. In one orchard I think it killed 90 per cent of the scale. The other orchard treated, the result was not as satisfactory. While spraying for oyster shell I noticed several trees badly infected with the eggs of the aphis. On examination of those trees this spring I discovered all the aphis eggs destroyed. Am so well pleased that I shall experiment largely this winter. Shall also try the caustic soda spray, which is so highly recommended by California horticulturists for scale insects. (One pound of caustic soda to six gallons of water.) In my last report I reported unfavorably in spraying with Bordeaux mixture for apple scab; am pleased to note the entire success of the spray, no scab showing the past season. A block of autumn strawberry apple trees were sprayed and the scab destroyed. No effect was perceptible till the following season.

One cherry tree was discovered to be badly affected with the cherry slug this season. One thorough spraying with whale oil soap and quassia chips exterminated them. Damage by the currant saw fly was very slight. Plum aphis were very numerous, but a thorough spraying with the above emulsion had the same effect. By reason of the use of a tobacco whale oil compound last spring, which was highly recommended (and proved ineffective) the apple plant louse had so increased in numbers that orchardists had great difficulty to save the crop, and in some cases almost failed, but thorough spraying with good whale oil

soap and quassia chips was generally successful in destroying them.

Last spring was cold, wet and late, which I think is favorable weather for the aphis, as they increased more than usual. They seem to be more numerous in orchards surrounded by timber. Orchards on the prairies are not seriously affected by them, owing to the prevalence of the lady bugs, which are so numerous in grain fields on prairies. Anthracnose of apple appear to thrive in cool weather, also. Have not had an opportunity to experiment with it yet. Orchardists appear to lack confidence in trying to check its advance, although instructed what to do.

While spraying last winter with the lime solution I tried some on some cherry trees that would shed their foliage in mid-summer, probably the effect of some fungus. The result was gratifying, as they did not drop their foliage till the proper time the following season.

Have noticed a small spot on apples about one-eighth of an inch in diameter, several together sometimes, dark brown or black; they do not penetrate the apple, but show on the surface as an unsightly blotch, more especially on Red June and MacIntosh.

Pear trees which were treated for blister mite the season of 1901 are still free from the mite.

Moles are a great nuisance to fruit trees on prairies, and can only be poisoned or trapped. They destroy a great many trees.

Owing to loss of one orchard report book the report on number of trees inspected is very limited, comprising the following:

Apple trees bearing, 13,639; non-bearing, 28,787; estimated crop, 13,110 boxes. Plum trees bearing, 868; non-bearing, 647; estimated crop, 791 bushels. Pear trees bearing, 274; non-bearing, 495; estimated crop, 115 bushels. Cherry trees bearing, 875; non-bearing, 2,411; estimated crop, 5,195 gallons. Total number of trees, 47,796.

Injurious insects found—Aphis, Redhumped Caterpillar, Codlin Moth, Red Spider, Cherry Slug, Hop Plant Louse; also Lice, Saw Fly, Moles, Fungus, Dry Rot and Anthracnose.

Very respectfully,

O. C. ESTEY,

Inspector Sixth District.

At the meeting of the Board held in Great Falls in January, 1904, it was decided to issue a bulletin on the codlin moth and other important dangerous insects and diseases. This work was prepared by the inspector at large and was issued and distributed from this office during March.

During this meeting the entire work of the Board and its officers was carefully gone over and plans for the year were made. The secretary's report was adopted, likewise reports of members and inspectors and ordered published in the regular report.

The subject of Montana's horticultural exhibit for the Louisiana Exposition was discussed and the secretary authorized to complete for the World's Fair Commission the labor of securing, preparing and caring for the best exhibit possible, with the fund appropriated for that work by the World's Fair Commission.

During the year ending November 30 there were received and recorded 74 notices of shipment of nursery stock, and there were 51 nursery stock salesmen's certificates issued.

The number of fruit inspectors' reports received were 77 and number of reports on inspection of nursery stock, 120.

Licenses issued to nurseries, 12; pamphlets issued, 1,000; reports issued, 1,000, and number of letters answered, 700.

Nurseries licensed to do business in the State of Montana: J. C. Jensen, Bingham City, Utah; the Montana Nursery Co., Missoula, Mont.; Jack Evans, Spokane, Wash.; Washington Nursery Co., Toppenish, Wash.; Wm. T. Grier, Echo, Mont.; L. L. May & Co. and Mayfield Nurseries, St. Paul, Minn.; Miller's Greenhouses,Helena, Mont.; Stark Bros. Nursery and Orchard Co., Louisiana, Mo.; The Jewell Nursery Co., Lake City, Minn.; State Nursery Co., Helena, Mont.; Oregon Nursery, Salem, Ore.; O. S. Chilcott, Rockvale, Mont.

FRUITS INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1904.

	Boxes.
Apples	130,374
Pears	13,601
Plums and Prunes	26,695
Peaches and Apricots	57,627
Cherries	9,416
Quinces	647
Oranges	42,510
Lemons	20,278
Grapes	3,743
Total	* 304,891

* Of this amount there was inspected in Butte City alone 147,659 packages.

For the two years ending Nov. 30, 1904, over 48 per cent of the total fruits inspected in the State were inspected by the Butte office. Of the total apples inspected in the State 35 per cent were Montana grown.

FRUITS CONDEMNED FOR YEAR ENDING NOVEMBER 30, 1904.

Apples (Codling Moth and Scale)	1,805
Pears (Codling Moth and Scale)	93
Peaches (Twig Bore)	61
Total	1,959

In addition to above several cars were sent out of the State as unfit for market.

FRUIT TREES, PLANTS, ETC., INSPECTED IN THE STATE FOR THE YEAR ENDING NOV. 30, 1904.

Apples	223,769	
Plums and P	12,559	
Cherries	26,961	
Apricots	129	
Peaches	576	
Quinces	538	
Crab Apples	3,822	
Pears	14,096	
		282,450
Shade and Ornamental Trees	38,985	
Shrubbery and Small Trees (N. O. S.)	32,381	
Roses	348	
		71,714
Blackberries	5,628	
Raspberries	15,113	
Strawberries	16,863	
Gooseberries	6,732	
Currants	5,509	
Grapes	210	
Asparagras and Rhubarb	297	50,352
Total		404,516

And 78 boxes mixed, not listed.

According to report of 1901 and 1902 there were 1,650,000 fruit trees out in the State. From the records of nursery stock inspected during the years 1903 and 1904, we find that there

have been set out in the State 524,104 fruit trees, making a total of 2,174,104. This would make the total fruit-tree acreage of the State 21,741 acres. It is impossible to secure figures as to acreage of small fruits, but a conservative estimate would place the total acreage of tree fruit and small fruits at 25,000 acres.

NURSERIES INSPECTED FOR THE YEAR ENDING NOV. 30, 1904.

Total number of acres	82½
Total number of small plants	25,000
Total number of trees	382,500
Total number of trees condemned and destroyed	1,600

Disease condemned for—Crown Gall.

NURSERY STOCK CONDEMNED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1904.

Apple Trees	8,322
Pear Trees	114
Plum Trees	202
Cherry Trees	503
Apricot Trees	1
Peach Trees	7
Quince Trees	2
Shade Trees	256
Blackberry Plants	477
Gooseberry Plants	17
Roses	13
Grape Vines	21
Strawberry Plants	124
Raspberry Plants	20
Total	10,079

Principal disease condemned for—"Crown Gall."

NUMBER OF ORCHARDS, TREES AND ACRES SMALL FRUITS INSPECTED, 1903-1904.

Total number Orchards	703
Total number of Trees	515,061
Total number Acres Small Fruits	184

DISBURSEMENTS "APPROPRIATION FUND" FOR FISCAL YEAR ENDING NOV. 30, 1904.

RECEIPTS.

Appropriation for 1904	$2,500.00	
Balance of 1903 appropriation unexpended	874.85	
Total		$3,374.85

DISBURSEMENTS.

General Expense—	
Printing	$ 20.04
Board Members' Expense	28.40
Inspector at Large, Service and Expense	[illegible].80
Second District—	
Inspector, Service and Expense	$8.30

Third District—		
Inspector, Service and Expense	$198.85	
Fourth District—		
Board Members' Expense	$ 52.15	
Inspector, Service and Expense	1,045.96	
Fifth District—		
Board Members' Expense	$ 50.00	
Inspector, Service and Expense	459.25	
Sixth District—		
Board Members' Expense	$ 17.60	
Inspector, Service and Expense	568.85	
Balance appropriation unexpended	446.65	
	$3,374.85	$3,374.85

RECEIPTS AND DISBURSEMENTS "FEE FUND" FOR FISCAL YEAR ENDING NOV. 30, 1904.

RECEIPTS.

Balance in fund from fiscal year, Nov. 30, 1903	$ 170.18	
Fruit Trees	3,214.71	
Nursery Stock	589.52	
License	300.00	
Rent	60.00	
Total		$4,334.41

DISBURSEMENTS.

Wages	$3,562.92	
Freight, Express and Transfer	24.60	
Rent and Supplies	330.75	
Traveling Expenses	37.65	
Telephone, Telegraph and Postage	110.21	
Balance on hand Nov. 30, 1904	268.28	
Total	$4,334.41	$4,334.41

MONTANA'S HORTICULTURAL INTERESTS AT THE WORLD'S FAIR AT ST. LOUIS.

At a meeting of the Horticultural Inspectors of Montana, held in Butte during July, 1903, at which Mr. Paul McCormick, secretary of the executive committee of the St. Louis Exposition, was present, the subject of Montana's horticultural interests at the exposition were discussed in all its branches.

As a result of this meeting the World's Fair Commission decided to place the work of securing and preparing a suitable exhibit of the fruits of the State in the hands of the Board of Horticulture.

This duty was accepted, and immediately upon the adjournment of the meeting, estimates of the cost of gathering and preparing a suitable exhibit were made and presented to the commission at a meeting held in September. These estimates called for an expenditure of $5,800, which amount was to cover all cost

of securing, preparing and maintaining an exhibit, covering 1,000 square feet. The plan called for one carload of apples to be prepared in the most scientific manner and placed in cold storage; 1,000 packages of small fruits to be shipped at stated intervals during July, August and September; one carload of apples and other tree fruits to be gathered and shipped about September 25th or October 1st, and 150 large jars of chemically prepared fruits.

After mature deliberation the commission found that it would be impossible to expend the amount requested. The total sum of $5,000 at their command was found inadequate to go around and the sum of $4,500 was finally agreed upon to cover all expenditures in the horticultural department.

It then became necessary to go over the estimates, curtailing here and there, dispensing with some parts entirely in order to come safely within the appropriation.

A final plan was then presented to the commission which called for one carload to be placed in cold storage, 500 packages to be shipped during the summer and one car to be sent October 5th.

While awaiting the decision of the committee regarding what should be done, about 75 small jars of small fruits consisting of berries, cherries, plums, apricots and peaches were secured and preserved in chemicals. No regular specimen jars were obtainable and small salt and candy jars, holding from one to four quarts, were used. These were used merely as ornaments to the exhibit.

In keeping with the final plan submitted, one straight carload of apples were gathered from all parts of the State. These, after arriving in Butte, were all examined one by one to see that they were free from all blemishes and the selected ones were then wrapped first in tissue paper, then wrapped in parafine paper. They were then securely packed in a box, a little larger than our apple box, and placed in cold storage until the car was completed. The box used was a tight box, lined with light manilla paper, ends and sides, the sheet being large enough to act as a cover when the box was filled. Between the paper and box was placed a thin sheet of excelsior, sides and ends and between each layer of fruit a layer of paper, then a layer of excelsior and then a layer of paper, thus insuring against bruising and providing for absorption of all moisture. Upon the end of each box a card

was placed giving the name of the exhibitor, his address, the name of the variety and the number of specimens therein contained. A complete record of the contents of each box was also made in a book. This car was completed about December 1st and loaded and shipped to St. Louis on December 24th, arriving there January 2, 1904.

To load and ship a car of fruit in the dead of winter such a long distance required judgment and care. Danger of freezing, chances of being caught in a wreck, possibility of sudden rise in temperature were questions of grave importance. The car used for shipping was a refrigerator style. All ice was removed; the ends. sides and bottom of car were padded with about six inches of clean straw. The boxes were laid across the car in rows of five; strips one inch wide were nailed across the row at each end, one being flush to one side of the car, the other flush to the other side. This was followed on up until the boxes were five rows high throughout each end of the car to the center. The center space or doorways was reserved for brace work to hold the boxes tight throughout the entire car. For this purpose two-by-four lumber was used. Straw was packed around the exposed ends of the boxes in doorways. When the car was finished it was ready to go a journey of almost any distance.

At the time of loading a sufficient number of boxes were opened and examined to test the condition of the fruit after being two and a half months in storage. Every specimen examined was found to be in perfect condition, as good as the day they were packed. At the same time there were opened a few boxes that had been packed for experimental purposes to be kept in Butte for study. The fruit in these boxes was bruised and otherwise unfit for exhibition purposes. The fruit consisted of Alexander, Wolf River, Wealthy, Pewaukees, McMahon White. Johnathan, etc.. and was packed simply to study the bruises at different stages. These were all found to be in the same condition as when packed, the bruised spots not having spread at all, rather they were inclined to show a gradual drying. The good apples that were packed in among them were all found to be perfect. Upon January 18th they were again examined and found in the same condition. The same procedure was followed in packing these bruised apples as was followed in packing the exhibit.

The Mound City Ice & Cold Storage Co., of St. Louis, to

whom the car was sent for storage, was instructed to open a number of boxes to note their condition upon arrival. The following, which is a copy of a letter received from them after the receipt of the car, tells how they arrived: "C. H. Edwards, Butte, Mont.: Car 5019 of apples was received and placed in storage January 2d. We examined several boxes of this fruit and found it to be in good condition. In this respect we beg to say that your shipment is one of the best packed cars we have received for World's Fair exhibition. We refer to condition of apples examined, how rapped and packed in boxes. The box itself and manner in which car was loaded to protect against breakage and frost. We assure you that such shipments are appreciated.

Yours very truly,

(Signed) F. S. TIMBERLAKE, Manager.

The contents of the car placed in cold storage was used during the summer from May to October to keep covered our space of 1,000 square feet. It was universally conceded by all horticultural superintendents that our pack and package was the very best.

Application for 1,000 square feet of space in the Horticultural Palace has been made during October, and after the shipment of fruits had been made the matter of installation of the exhibit was taken up. In view of the fact that funds were small, low installation was decided upon. While this plan of installation deprived us of an opportunity of much adornment it, we believe, gave the advantage of presenting to the visitors our entire exhibit at a glance.

On April 15th we went to St. Louis to begin the work of installation. On April 30, 1904, the day which the fair was formally declared open, Montana's horticultural exhibit was complete and from that time to December 1st, the closing of the Fair, Montana was well represented in the Palace of Horticulture, exhibiting throughout the season no less than 10,000 plates of fruits.

While in St. Louis during the month of June we had a good opportunity of observing the poor condition of the small fresh fruits that were received by the nearby states and decided then that it would be utter folly for us to attempt the local shipment of small fruits during the months of July and August, as was our intention. Then, too, our fund available was small for this work and the express rate of $5.50 per 100 pounds made it possi-

ble for us to ship only a very few shipments. Had it been possible to get them there in good condition, we would have attempted to have shown strawberries and cherries and other small fruits, fresh from the orchards; but as it was not, the plan was abandoned.

During the summer months of 1904 the fruit growers of Montana were again solicited for fruits for a second car with which to close up and make a good finish. About September 15 the work of assembling at Missoula this second car was commenced, and upon October 1st the same was shipped to St. Louis. The car arrived there about October 10th. This car contained about 15,000 specimens, consisting of apples, crabapples, plums, prunes and pears. It arrived in good condition and completed the work of gathering and packing of fruits for the fair. The receipt of this choice car enabled us to show an abundance of beautiful fruits during the last two months of the fair. During October we were showing in good condition apples of 1903 and 1904 at the same time.

It has been no easy task, indeed, to maintain for a period of seven months an exhibit of fresh fruits, covering a space of 1,000 square feet and consisting of 10,000 plates of fruits, when we take into consideration the fact that our base of supply was distant from St. Louis about 2,000 miles. It required the greatest care possible to maintain an exhibit of cold storage fruits alone, lasting over a period of five months, yet during this period Montana's exhibit compared favorably with all of the western states, especially when we remember that she spent in the horticultural department less than half the money spent by the least of the states.

Throughout the entire work the strictest economy was practiced. Not one needless dollar was spent.

It would, of course, be impossible that our horticultural exhibit should come up to the expectations of all the people that saw it, and of many of our own citizens who visited the fair, yet it is a fact that no exhibit in the horticultural palace attracted greater attention. It is universally conceded that Montana stands at the head as a mining, agricultural and stock raising state, but that she could claim a place in the category of fruit-growing states has not been credited by the people outside of her own borders, and, indeed, by many living within her domain.

It is our opinion, formed from observations made during our

visit to this educational fair just closed, in connection with this work, that the money expended in our horticultural exhibit will prove of inestimable value to our state.

Aside from the value as an advertisement to the world of our horticultural possibilities, we consider the effort put forth along this line of great worth to the grower of fruits. From this work we hope to learn something of the keeping qualities of our apples under the most trying conditions. This in itself is valuable.

A careful record of each variety placed in cold storage was kept, and this data will be published later in the form of a special bulletin. Photographs of the leading varieties were made and these, with a complete history of the fruit and tree will form a part of the bulletin.

We believe that Montana may justly feel proud over the results attained through her horticultural exhibit. The small amount of funds available compelled the strictest economy in all matters. The extent of the exhibit was necessarily smaller than might be desired and it was impossible to show a great variety of fresh fruits on account of the almost prohibitive rates. Notwithstanding these drawbacks, we think a good showing was made. The entire number of exhibitors were but sixty-seven. During the entire period of the fair, seven months, there was maintained an excellent exhibit by these progressive orchardists, and to sixty-one of these gold, silver and bronze medals were awarded, and an additional silver medal to the commission on installation.

LIST OF FRUIT EXHIBITORS.

F. L. Cook, Como.
R. A. Sleeman, Lo Lo.
R. A. Parkhurst, Victor.
A. N. Mittower, Victor.
J. R. Willis, Plains.
Wm. Porter, Woodside.
Thos. S. Smith, Carlton.
Ida F. Cottrell, Carlton.
M. H. Pierce, Plains.
C. O. Johnston, Carlton.
Victor Mine Orchard, Victor.
W. J. Crismus, Rockvale.
A. J. Durnford, Carlton.
Appolino & Waters, Victor.
R. A. Eddy, Victor.
J. L. Lacaff, Florence.
F. G. Pickering, Joliet.
R. V. Jamieson, Victor.
E. F. Burger, Joliet.
Mrs. Lizzie Murphy, Carlton.
J. H. Lehson, Missoula.
W. J. Tiedt, Darby.
J. P. McClain, Carlton.
J. O. Read, Hamilton.
O. C. Estey, Big Fork.
A. C. Vanderpool, Plains.
C. C. Willis, Plains.
J. F. Lewis, Plains.
E. A. Meyers, Hamilton.
G. L. Saterlee, Darby.
J. C. Colcord, Stevensville.
B. George, Darby.
A. C. M. Co., Hamilton.
E. A. Johnson, Hamilton.
MacRae Bros., Victor.
C. W. Smith, Woodside.
W. Turnage, Woodside.
W. B. Harlan, Como.
Thomas Deering, Como.
F. E. Lockridge, Corvallis.

Isadore Wagner, Florence.
W. P. Maclay, Missoula.
W. J. Allen, Carlton.
Samuel Dinsmore, Missoula.
Frank Engler, Victor.
L. Lacrousier, Victor.
S. Wagner, Florence.
Fred Gilbert, Lo Lo.
Bitter Root Stock Farm, Hamilton.
W. H. Rock, Lo Lo.
Bass Bros., Stevensville.
T. A. McClain, Carlton.
Missoula Nursery Co., Missoula.
Gus Gorus, Darby.
Fritz Hendricks, Woodside.
J. E. Hauff, Woodside.
J E. Lockwood, Woodside.
L. H. Johnston, Victor.
John Sears, Woodside.
D. E. Bandman, Missoula.
Thomas Padden, Darby.
De Veber & Herbert, Florence.
Billings Land & Irrigation Co., Billings.
State of Montana.
Fred Grill, Hamilton.
O. C. Cooper, Hamilton.

LIST OF AWARDS.

Gold Medals.

State of Montana.
Bass Bros., Stevensville.
Bitter Root Stock Farm, Hamilton.

Silver Medals.

F. L. Cook, Como.
R. Parkhurst, Victor.
Thos. S. Smith, Carlton.
Ida F. Cottrell, Carlton.
M. H. Pierce, Plains.
Henry Johnson, Carlton.
Victor Mine Orchard Co., Victor.
Appolino & Waters, Victor.
J. F. Lacaff, Florence.
R. V. Jamieson, Victor.
W. J. Allen, Carlton.
Samuel Dinsmore, Missoula.
L. Lacrousier, Victor.
S. Wagner Florence.
W. H. Rock, Lo Lo.
Gus Gorus, Darby.
J. H. Lehson, Missoula
W. J. Tiedt, Darby.
J. P. McClain, Carlton.
A. C. Vanderpool, Plains.
C. C. Willis, Plains.
J. F. Lewis, Plains.
G. L. Satterlee, Darby.
J. C. Colcord, Stevensville.
Ben George, Darby.
McRae Bros., Victor.
W. B. Harlan, Como.
Thos. Deering, Hamilton.
E. A. Johnson, Hamilton.
Fritz Hendricks, Woodside.
J. E. Hauff, Woodside.
J. E. Lockwood, Woodside.
L. H. Johnson, Victor.
John Sears, Woodside..
Thos. Padden, Darby.
DeVeber & Herbert, Florence.
T. A. McClain, Carlton.

Bronze Medals.

J. O. Read, Hamilton.
E. A. Meyers, Hamilton.
C. W. Smith, Woodside.
Wm. Turnage, Woodside.
F. E. Lockridge, Corvallis.
Fred Grill, Hamilton.
F. G. Pickering, Joliet.
Mrs. Lizzie Murphy, Carlton.
Isadore Wagner, Carlton.
W. P. Maclay, Missoula.
Fred Gilbert, Lo Lo.
Missoula Nursery Co., Missoula.
R. A. Sleeman, Lo Lo.
A. N. Mittower, Victor.
J. R. Willis, Plains.
Wm. Porter, Woodside.
C. O. Johnson, Carlton.
A J. Durnford, Carlton.
Dan'l E. Bandmann, Missoula.
O. C. Cooper, Hamilton.
Billings Land & Irrigation Co., Billings.

In addition to the above list there was awarded to the Montana World's Fair Commission a Silver Medal for Installation.

During the entire season of the fair the exhibit was cared for by Mr. Verdi Spurgin. That it was in good hands is evidenced by the results as shown in the matter of awards. It would have been impossible to have found a gentleman better fitted for this work. To his untiring efforts is due the credit of our success. He has labored early and late for eight months, never losing

sight of a single opportunity to advance the interests of the state, and we desire to express to him our sincerest thanks for his many efforts to carry to a successful close the exhibit.

In conclusion we wish to express thanks to the commission for their many courtesies extended, and for their earnest efforts on behalf of the fruit interests of the state; to Mr. Buskett, representative of the commission, and to the fruit growers of the state for their earnest co-operation, and to the press for its kindly assistance.

REPORT OF E. N. BRANDEGEE TO STATE BOARD OF HORTICULTURE.

Gentlemen: A great change is manifest in the fruit now coming to market in Montana compared with that of five and six years ago. Eastern apples then came in unrestricted, infected with all the pests. Western apples and pears were sent as indifferent horticulture had grown them. Market conditions did not demand the best fruit nor even good fruit. The supply was accordingly infected with codling moth or some other common pest. Five years ago pears, apples, peaches and plums were infected with San Jose scale and a visit to market would disclose any quantity of it.

The San Jose scale has almost entirely disappeared now from market fruits. A year at a time passed without a fruit inspector discovering, after earnest search, more than a specimen. Other scale insects are comparatively as rare now, and even the codling moth appears in much reduced numbers. The market fruit of Montana is probably the best in the world. It is as good as favored localities and intelligent and diligent horticulture can produce. About one-half the apples consumed in the state are home-grown. The other half comes from orchards that are pruned and sprayed to produce fruit to meet Montana demands. One horticultural law has thus had a wide influence for the growth of scientific horticulture in these states. It was a notice to growers that they must grow the best fruit or keep out of our market. And the commercial orchards of the Pacific states are kept as free from pests as in infected regions is possible with present horticultural methods.

The better fruit now grown and found in market suits the taste of the consumer and excellent fruit adds always to the de-

mand. It is an advantage to the wholesale and retail trade, as more is to be made in good fruit, and especially in fruit that endures market conditions. But for the fee system, the inspection of fruit would meet with universal approval, and it has improved horticultural conditions in the Northwest as no other means, perhaps, that could be devised could do.

It has called to common notice the importance in horticulture of scientific methods and the injury to be wrought by horticultural pests. It has impressed upon the growers of the state the necessity and advantage of keeping those pests away so far as possible. In most state laws to make them effective need individual co-operation. Fruit inspection keeps before the grower an ideal to which he must attain, and individually and collectively this state has benefitted by the fruit inspection law.

Comparatively few pests, however, are distributed by fruit. Nursery stock disseminates many times more. When the horticultural law was passed, it was soon discovered by the Board entrusted with its operation that the nursery stock sent to this state was often of the basest quality. Trees by the tens of thousand were bought and sold that were valueless, and often much worse than valueless to the buyer. Scale insects that might spread and injure entire valleys were sent in to us. Plant diseases that were as injurious came in, often without the knowledge of the seller and, of course, of the victim who bought and planted the infected trees.

This condition was very unfavorable to horticulture and to the growth of orchard tree raising in Montana. It took all profit out of many orchards that were planted, threatened with contagion good established orchards and discouraged sometimes entire valleys as to the possibility of apple culture. There have been instances where infected stock that would not live anywhere has been sold in quantity in the same region and its subsequent death has been attributed to climatic influence, whereas it was due to contagious disease. This postponed the horticultural development of sections of our state and blinded the inhabitants to their own horticultural possibilities.

The Board immediately initiated the inspection and fumigation of nursery stock. This continues to the present time with greater efficiency than at first. More nursery stock, comparatively, is seen and treated. And inspectors have become familiar with the details of the work. The nurseries of the country have

learned, and some of them by sad experience, that nothing but healthy stock can be sold in this state.

The inspection of nurseries and the inspection and destruction, if necessary, of nursery stock is a work of great importance to this state and horticultural interests would suffer if the work should be allowed to cease. Local nurseries are not in every instance free from contagious disease. But they are free compared with imported stock. A single infested nursery may be the means of the spread over an entire state or several states, if unrestricted, of a highly contagious disease or an insect whose subsequent eradication is nearly impossible.

It is of the highest importance that all the nurseries of the state be thoroughly inspected above ground and below ground. It is equally important that all nursery stock, so far as possible in this state of magnificent distances, be thoroughly treated. The Board has endeavored to do this and I believe has succeeded better than other states with similar laws and has saved in this alone to the horticultural interests of the state many times the total cost of the law. But this is the most important part of our work in restricting the spread of horticultural pests, and all means should be devised to give it more system and make it complete as possible.

Nursery stock continues to be infected and as many trees, proportionately, are condemned and destroyed as when the Board first undertook inspection of it. Nearly all young trees that come into the state are accompanied by certificates of character printed and purporting to be signed by state inspectors or professors of the experiment stations in the states where the nurseries are located. If these certificates were trustworthy, our work on nursery stock would be much simplified. But they are totally unreliable. They are found attached to stock that is badly infested. No diseased stock has as yet come into the state that was not accompanied by a certificate setting forth its immaculate condition, and one bad carload last spring had three cards of introduction from as many states. Their use in this way to cover fraud may not be warranted by those who issue the certificates, but in any event they indicate that inspection of nurseries and nursery stock is as yet in other states carelessly performed.

The horticultural law has done valuable work in Montana

on nurseries and nursery stock. And it is here that most is done in restricting the spread of pests. Nearly all the destructive pests are disseminated by nursery stock. Infested fruit menaces us but with one, but this is the most injurious insect, and fruit inspection should be maintained specifically for this pest and for its work in fruit. But the inspection of nursery stock is of greater moment. If we get San Jose scale on growing trees in Montana it will come to us on nursery stock. Our oyster shell bark and woolly aphis came to us in that way and if the state gets them, so will any of the scales that infest trees. Most all insects but the codling moth are distributed on nursery stock, and the various plant diseases are distributed in this manner alone.

Fruit inspection and the inspection of nurseries and the inspection and fumigation and destruction, if infected, of nursery stock, is but a part of our work. Several injurious insects and plant diseases have been introduced into the state and have become firmly established. The control of these, at least, and their eradication if possible is the work of our horticultural law. Extensive work has been done by us in locating and determining the troubles, and doing away with them as fast as possible. I will specify a few of them.

Oystershell Bark Louse.

This scale insect was introduced some years ago and is now found in several orchards in Flathead, Ravalli and Missoula counties. It is a serious pest, well adapted to thrive in Montana and tends to extend its ravages. No satisfactory method of killing this insect has been used until recently. Kerosene emulsion applied at the time when the young are just hatched is effective in practice to a limited degree. The spray kills the unprotected young that it touches, but great irregularity is manifest in the time of hatching of the eggs in the same locality and different localities of the state. At no time can the spray be applied so that it will kill more than a fraction of the insects. In all these counties the inspectors last year or this year have used lime-sulphur mixture. In every instance its use has proved effective and undoubtedly in the future this spray will be extensively used in Montana for all scale insects.

Lime and sulphur (the salt is better omitted) must be applied to the dormant tree and never when it is in foliage. A formula

much simplified will be found in this report. The trees should be well pruned before spraying for oystershell bark. Two applications, one in the fall after the leaves are gone, and one in the spring as late as possible before the buds have burst, clean trees pretty thoroughly of this scale. The last application is undoubtedly most effective, and operates on the young after hatching in a marvelously effective manner.

The work on the oystershell bark should be continued until all orchardists who have this insect on their premises are familiar with this spray. Its use in Montana has been delayed and the good retarded that might have been attained by its use. The experiments of Prof. Aldrich in Idaho indicate that it is the most effective spray for aphis. It is well known by our own experiences that it is the most effective means of controlling pear leaf blister mite. Against the bud moth it is effective and against red spider and clover mite and woolly aphis and possibly it has a fungicidal value. It is recognized to be the best insecticide known in horticulture, and of most general application, and its work should be watched by all inspectors on aphis of all kinds, as well as those enumerated and others, notably borers.

Codling Moth.

As usual this insect has taken its quota of time and effort in the endeavor to keep it out and to get rid of it in the places where it is already established. The inspection work of Mr. Read has disclosed its presence at several places in the Bitter Root valley and it has been there for a number of years from indications. One orchard at Flathead Lake, and the cities of Kalispell, Missoula, Thompson Falls and Helena are the other infected districts.

At Missoula the problem is the greatest and the work has been the most extensive. There are from six to eight thousand trees in the town affected with codling moth. Some of these trees are thirty years or more old. Their great size and proximity to sheds, barns, fences and houses, all affording ideal winter habitation to the insect, makes its control there a matter of great expense. The local inspector has sprayed and endeavored to make others spray, but the problem is an unwieldly one. It may yet be solved, but never without the hearty co-operation of the city with the Board of Horticulture.

In this respect Kalispell has set an example which Missoula

may well imitate. The city co-operated with the Board in securing a special inspector. They were fortunate in the selection of Mr. Wood, who gave to the work unusual ability and enthusiasm. From a personal inspection of the work done by him in spraying and banding and picking infested fruit I can testify that everything was done that could be done to eradicate the moth in Kalispell this summer.

Kalispell is not a center where many freight cars are stalled. It has but a tenth the number of infested trees that Missoula has, and none of thes are large. The problem of the moth is comparatively simple there, yet indicative of what may be accomplished in the larger field. The work of Mr. Wood and Mr. Hartman and Mr. O. C. Estey at Kalispell and Flathead Lake will be watched with great interest. It will demonstrate pro or con the possibility of the eradication of the moth when once firmly established.

It may be early to rejoice over the great results of the work. But the indications are that the moth has been eradicated at Flathead Lake, and that he will be very scarce in Kalispell next summer. If so, or in any event the same methods should be employed in the Bitter Root infected districts and in the orchards surrounding Missoula and at Thompson Falls next season.

In the railroad centers of the state the danger from reinfestation is greatest. Not only does this come from infested fruit, but from infested cars. In August, September and October codling moth may be found in the fruit or boxes, but in no other month of the year. It is at this time freely distributed in this way. Every car from an infested district in these months contains more or less of them, no matter how careful the inspection. Fruit inspection has greatly diminished the number to be found, but nothing but total exclusion can do away with infestation from this cause. This is slowly coming to pass. One half the apples used in Montana are now of home production, and in fruit raising districts the apples that are imported from abroad are very few. With pears the record is not as good.

But reinfestation from fruit aside, and that will not come to pass for some years at Missoula and Helena, there is still the railroads. The greater dissemination of the codling moth is the railroad, even when it is not carrying cars of fruit. Cars that have been loaded with infested fruit become badly infested

with larvae of the moth. In protected situations in these cars they make their winter cases and travel over the country through the entire winter securely housed. In the month of May such cars may be lying at Missoula or Helena or any other railroad center. Here their pupation completed the moths emerge and fly to any neighboring fruit trees. Such infected cars may not be loaded with fruit and usually are not at the time when they become a source of danger to orchards. They may be found in produce cars and sometimes in furniture cars; in fact, in any car that has been used for the shipment of apples in other states when the last brood of codling moth was seeking its winter location. A car of apples from the Bitter Root last spring contained fully a hundred moths and in a car of onions from Hamilton somewhat more than that number could be seen.

In all orchard communities the provision of the law in regard to the destruction of empty fruit boxes is very just. Codling moth is distributed very readily in old apple, pear and quince boxes and in other boxes that were loaded in the same car with these fruits. I am glad to report that in apple regions the law in regard to their destruction is more generally observed. In Kalispell not an emppty fruit box has gotten out from the grocery stores this year and in the Bitter Root their destruction is more general than before.

Crown Gall.

This most prevalent and destructive enemy of nursery stock is very common on trees imported and native. A large variety of trees are reported as affected by it in other states, but in Montana I have seen it on the apple alone.

The presence of the disease is indicated by round, warty swellings at the crown of the tree or on the smaller roots. The union of stock and scion is perhaps the most common and fatal point of attack. But the gall frequently appears above and below this weakest portion of the tree, and seedlings are affected as readily. A recent examination of a shipment of home-grown stock disclosed only a third of the trees affected at this point, and the remainder but one with galls elsewhere on trunk and roots.

This disease is very destructive to young apple trees in the state and is a pest that requires the greatest vigilance on the part of the Board to prevent its distribution. All nursery stock infested with it is worthless except to sell, and most nurserymen

are willing to part with it for a consideration. Such stock will not bear fruit. It may grow for a period of years only to die, when it should be remunerative, thus throwing on its unfortunate purchaser cost of trying to grow it in addition to its original price.

In irrigated ground the disease is most virulent. The Bitter Root has suffered more from it, according to reports, than has the Flathead. The germ seems to be freely distributed by water. In the course of time local nurseries will be seriously troubled by this disease, and the course best to be pursued by you in dealing with infestations should be dictated by the experience of the country and the importance of the interests at issue.

Apparently but few nurseries of the country are totally free from the disease. All that the Board can do then in the case of a badly infested nursery is to have an inspector present when the stock is dug and destroy all trees that are infected, and in nursery shipments, to cull and destroy all that show signs of the disease. The presence of a quantity of Crown Gall, however, in any shipment subjects the remainder to grave suspicion, and when half the trees have these galls upon the roots the entire shipment should be destroyed. Thousands of trees have been destroyed in Montana by inspectors for this cause alone.

Woolly Aphis.

This insect is often met with on nursery stock. When detected the tree is destroyed. Fumigation does not destroy it in the egg form and it is to be expected that orchards will show its presence sooner or later. Mr. Read has reported it in the Bitter Root this year. Inspectors should see that trees, where it shows itself, are properly treated. Kerosene emulsion, or lime-sulphur should be sprayed on the trunks for the aerial form in the summer time, and the earth taken from the base of the tree and the galls flooded with boiling water, and the earth replaced.

As the state gets older and the orchards become larger and more numerous the ravages of insects and plant diseases will become greater and the outbreaks more frequent. The time has already passed when the state can expend funds save in cases of emergency or for experiment in spraying a city or in individual orchards. It should compel owners of premises infected with pests liable to spread, to spray or in other ways eradicate them and supervise the work if necessary with a man skilled in the

work. But pumps and mixtures and manual labor should be supplied by the individual or community benefitted.

The horticultural law has had a great influence for good on the fruit industry of the state. It has stimulated the planting of trees. It has kept market conditions to be met before the mind of the planter. It has improved his market and has given his investment a greater certainty of future profit.

I wish that a campaign might be inaugurated to induce top-grafting of worthless varieties now bearing, and the planting of none but suitable market varieties in commercial orchards. Nothing could be of more benefit to the industry. The Board of Horticulture should issue a bulletin on the different varieties that do the best in the different sections of the state—that produce a good market apple and are trees suited to the climatic conditions.

Helena, Mont., December 1, 1904.

Plains, Mont., January 3, 1905.

President State Board of Horticulture.

Dear Sir: I beg leave to make the following report from the Fourth District of Montana:

I should think that the fruit tree planting had increased 10 per cent in the last year, and I find the growth has been very satisfactory the past season, where the trees had plenty of moisture. The fruit crop was not so large as usual, on account of late frosts, which injured especially apples and plums. I find the past season has been very favorable to insect growth, and I find in my district the codling moth has increased with great rapidity in the infected districts, with all our efforts to hold them in check, though I am told by the inspectors that they have not spread over any more territory, but the damage to the fruit has been 80 to 90 per cent in some orchards. I think there will have to be some other plan pursued to hold them in check besides the method now in use by the Board, as the infected districts get all the appropriations made by the state and they still setting more trees from year to year, and it makes the work of spraying far greater each year. I find the people of Missoula very careless in the matter of spraying and seem to care very little for the welfare of the fruit-growers of the state. They seem to think the state should spray and look after their orchards

free of charge. I think if the law could be amended to put a tax of one cent on each fruit tree in the state outside of the towns and 50 cents each for all trees set in the towns, the money going to defray the expense of inspection and spraying the trees of the state and the tax to be collected the same as other taxes. If this could be done it would discourage the planting of orchards in all the towns of the state, for in the towns is where the codling moth makes its first appearance and gets a good start before it is discovvered. I find the lime, sulphur and salt spray applied two or three times destroys the oystershell bark louse. There will have to be some radical measures taken in these infected orchards to get rid of the codling moth or they will soon spread over the entire state and ruin the fruit-growing industry that looks so promising now.

C. C. WILLIS.

Mr. President and Members of the State Board of Horticulture.

By request of your secretary I send my second annual report as member of Board of Horticulture for Fifth District of Montana.

The work on insect pests and fungus has been very satisfactory, especially regarding codling moth. The work in Kalispell has been in charge of Mr. J. C. Wood, who has been very earnest and thorough in his work and I feel assured that he would have succeeded in exterminating the codling moth were he backed by sufficient funds. His records show a greater degree of success as compared with records of previous year. Feel assured his report will be satisfactory to the Board.

In September, 1903, I found seven apple trees in which there were wormy apples (in the Lakins' orchard at Big Fork) from which the codling moth larvae had emerged. As this orchard is in the vicinity of several larger ones, I thought best to take it in personal charge and try to exterminate the moth, which proved entirely successful, not finding a live larvae this season, nor a wormy apple. Although I was informed by entomologists that to entirely exterminate them was impossible.

The season was favorable for the work, due to lack of rain while spraying. The owner of orchard sprayed under my personal supervision. It was sprayed the forepart also the latter part of June.

The first spary was prepared by adding two pounds of slaked lime, strained, one-third pound commercial paris green to forty gallons water. The extract of six pounds of quassia chips and seven pounds whale oil soap (the latter being qualified with C. potash), was added to destroy the green aphis.

The second spray had just half the quantity of lime added as the first, otherwise the same. After the second spray a few dead larvae were discovered partially in calyx of apples, also a few places where worm had apparently eaten and got enough poison to destroy it. The fruit growers of the locality aided the work financially and materially. Should the results be as successful as now apparent the Board has done incalculable benefits to the fruit growers of that locality, as about 25,000 apple trees are growing within a mile of the orchard which was affected. The apple plant louse has been very prevalent the past season, increasing very fast. Whale oil soap and quassia is mostly used and appears to be the most efficacious, if what is known as potash soap and quassia shavings in preference to what is known as hog ships can be procured. Six pounds quassia, seven of soap to forty gallons of water is the preferable solution here. I discovered the aphis in thirty orchards, which were badly infested, not noting other. Pear leaf blister mite was discovered in six orchards. As pears are not considered a commercial fruit in this district the mite is not much dreaded.

The past season evidently was favorable for the development of peach leaf curl. Trees that were never affected before showed evidence of the curl this summer. Late in season it disappeared. I cut back several and removed foliage, washed body and limbs with whale oil soap. Will note results next season.

Discovered several orchards in one locality affected with twig blight; recommended cutting back and spray with Bordeaux mixture, full strength, in the winter, modified in summer. Orchards are too far from my home for me to work on them experimentally. The oystershell bark louse was found in four orchards, one of which has been sprayed the past two seasons. There are very few left—only a thorough investigation will disclose them. I sprayed in March, 1904, with lime sulphur and salt (same solution as recorded in my last report). I also tried potash solution, six pounds potash to forty gallons water, so highly recommended in California, with practically the same re-

sults obtained by former solution. While experimenting on aphis eggs March 3, 4 and 5, 1904, I tried 15 pounds lime, 15 pounds salt, 15 pounds sulphur to 40 gallons water. Also 15 pounds lime, 15 pounds salt, 6 pounds potash in 40 gallons water, with no apparent effect on aphis eggs. It is possible spraying was too late in season—shall try earlier the coming winter.

The sooty fungus is becoming quite serious on thin-skinned apples, as Red June, Macintosh, etc., which will require spraying with Bordeaux mixture. Leaf blight of apple, cherry and pear is quite common. The cherry slug is found frequently, but is destroyed by contact with poison or caustic.

The writer discovered in two orchards a worm about 7-16 of an inch in length which works in the apple much the same as larvae of codlin moth. It enters the apple at the side and apparently passes an extended period in the vicinity of the core, as the entrance becomes covered by a thin film nearly the color of apple, which makes it difficult to find entrance. The writer sent specimen of apples containing worms to U. S. Entomologist at Washington and it was not recognized. Should it become more plentiful it would prove a serious menace to apple growers.

Cherry worm was reported late in season (too late to be investigated) from our locality.

Mr. Fred Hartman, inspector of green fruits in Kalispell, is to be congratulated on the thoroughness and success he has attained in his work. He has proved to be a very efficient officer and has been especially particular in enforcing rules 3, 4, 5 and 6 of the Board of Horticulture.

Yours very truly,

O. C. ESTEY,

Member of Board of Horticulture for Fifth District, Montana.

Big Fork, Mont.

Orchards inspected by O. C. Estey, 72; days inspecting orchards and nurseries, 29; days special on codling moth, 11; total number of days at $5.00 per day, $200.00. Paid for spraying materials, $15.90; paid for extension rod, $7.50; total, $223.40. Expense to Great Falls meeting of Horticultural Board, $17.60. Total number of trees inspected, 38,579; apple, 31,965; plum, 1,908; pear, 602; cherry, 4,026; peach, 147. Acres of small fruit, 59¾; nurseries, 2; number of trees in nurseries about 150,000.

Number of orchards in which the following insects were found: Aphis, 30; pear leaf blister mite, 6; twig blight, 2; oystershell bark louse, 4; sooty fungus on apple, 3; leaf blight, 1; cherry slug, 2; small worm in apple, 2; root gall, 1; blackheart, 1; codling moth, 1; red humped caterpillar, 5; leaf spot, 1; apple scab. 1.

Orchards inspected by J. C. Wood: Number of orchards inspected, 36;; total number of trees, 24,355; apple trees, 20,901; plum trees, 1,313; pear trees, 518; cherry trees, 1,923; peach trees, 113; total number nurseries, one-half acre strawberries, small fruits, number of acres, 12¼.

Days inspecting orchard, 16; days special codling moth work in Kalispell banding trees, examining same, screening warehouse windows and extra work, 28.

Bill of J. C. Wood—44 days at $5.00 per day	$220.00
Wire screen and tacks for warehouse windows	3.40
Repairs and hose for spray pump	14.55
Express charges on extension rod	1.60
Total	$239.56

Number of orchards in which the following insect pests or fungii were found: Twig blight, 1; aphis, 18; codling moth, 3; tent caterpillar, 1.

The town of Kalispell is classed as one orchard, for convenience and brevity. Mr. Wood will give the result of his work in Kalispell in his report, which has not been received up to this date.

O. C. ESTEY.

Big Fork, Nov. 1, 1904.

Great Falls, Mont., Nov. 1, 1904.

C. H. Edwards, Secretary State Board of Horticulture, Butte, Mont.

Dear Sir: From Nov. 30, 1903, to Oct. 30, 1904, I have inspeced and fumigated 33 packages of nursery stock. Have also inspected and passed 45,908 packages of fruit, and am glad to report that in the last four years fruit has never been received in this district that equals that of the year 1904.

The small fruits for the past season have been especially fine, and it has been almost impossible to find codling moth in the apples or pears this year, which I think is due to the rigid inspection law that has been enforced for the past four years in

this state, as well as the favorable conditions of the past season and the labor and expense which the growers have undergone to rid orchards of the pests.

There was more fruit raised in Cascade county the past season than ever before, and I look for a great many apple trees to be set out here in the next few years, as it has been proven to us that a hardy variety of apples, when protected and irrigated, can be raised in a great many localities of the Third District.

We had a much larger display of fruit at the Cascade County Fair this year, which was raised in this county, than ever before, and one of the remarkable features, which we were all proud of, was a very fine basket of strawberries, which were raised here in town and picked on the morning of the 26th of September; and, even as late as the 4th day of November this man brought me a box of green and ripe strawberries and strawberry blossoms which he had picked that morning.

I have kept a careful inspection of the stores and warehouses and seen that the fruit boxes were burned, rather than being scattered all around town.

Although we have not had as much nursery stock shipped in the past season as we have some years heretofore, what has been coming has been in very much better shape, and I do not see as many irresponsible fruit tree agents through the country as we have had in years gone by.

At the meeting of the State Horticultural Society held here last winter, there was a great deal of enthusiasm shown by the people of Cascade county, and think that it did a great deal to encourage the raising of fruits in this part of the state.

Owing to the fine conditions which the fruit trees are in in this session, and to the low financial condition of the State Board of Horticulture's funds, did not deem it advisable to make a thorough orchard inspection this year. However, have carefully investigated anything that seemed to be wrong.

The trees in the city nursery here, which are composed mostly of elm, ash and maple, numbering about 20,000 in all, are in a very healthy condition, and the growth which they make is remarkable; and the young elm and ash trees along our boulevards have been much freer from pests, particularly elm aphis, than usual.

Very respectfully submitted,

C. E. HUBBARD,

Inspector Third District.

Hamilton, Mont., Nov. 1, 1904

To the Montana State Board of Horticulture.

Gentlemen: During the year I have endeavored to make as careful examination of the orchards of my district as it has been possible for me to do with the limited means afforded by the present law. I have held to the opinion that it was far better to make a careful inspection of a few orchards than to endeavor to casually observe the many. I deemed it best to go over each orchard visited with the utmost care, to learn positively whether any disease of a dangerous character existed, and to spend sufficient time with the owner to enlighten him, where it was necessary, as to best methods of combatting and eradicating diseases and injurious pests.

In the two years, 1903 and 1904, I have carefully examined 296 orchards, containing 429,000 trees, consisting of apples, pears, plums, prunes, cherries and peaches, apples forming about 90 per cent of all trees, and about 70 acres of small fruits.

I have found no new diseases or insect pests other than those reported in my report of 1903. The disease and pests found are codling moth, three instances; oystershell bark louse in four orchards; woolly aphis in several places; flatheaded borer, common; and crown gall in many orchards. All of these pests have been in existence for years, especially the oystershell, borers, woolly aphis and crown gall, and according to the best information obtainable the codling moth has existed in the district for several years.

I find that it is a hard matter to obtain from the growers, generally speaking, any information as to the possible infection of their orchards by the moth. It would appear, from all that has been written and printed concerning the history and habits of the moth, that no individual need be unacquainted with this pest, or fail to note its presence in the orchard. Still I find that many growers have yet to learn how to detect it, to know it when they see it. In several instances I have been called upon to visit orchards reported to be infested with the moth, but after careful inspection have found the trouble to be something other than supposed.

The question is always asked each fruit grower visited, "Have you ever found any wormy apples in your orchard?" The answer has always been, "No." Only in one case have I been told that wormy apples were found in the orchard and in this

orchard the moth was found and from the owner's own experience and knowledge it had been there for years.

It would, indeed, be difficult to say how the moth was carried into the few orchards in which it has been discovered in this district. When we consider the many avenues through which we are liable to infestation, we cannot help but be surprised that we have escaped the ravages of this pest so long. Nothing but the strict quarantine that the Board has maintained against infested fruits has delayed its spread throughout the Bitter Root. Nothing but an embargo against the importation of fruits liable to infestation by the moth can keep out this pest, and I doubt even then if it could be done. I have noticed the moth in various stages in refrigerator and box cars, standing upon the sidings in the valley awaiting their load of freight. How many have escaped from these cars? Then, too, it may be, and no doubt has been, carried from these cars upon articles of freight into distant orchards. That would account for the infestation of orchards so far from the railroads. Every grower should study the history and habits of this insect and learn how to combat it. No one should rely upon the dangerous idea that climatic conditions will keep out the moth or render its destructive ability less here than elsewhere.

In the report of the inspector at large will be found instructions for the eradication of the diseases which I have reported, and the reader is referred to that portion of this volume.

Sun scald is a frequent form of injury found in the district, It is considered a form of winter injury. The long exposed trunks receives the ray of the sun, a condition favorable to the bad results following rapid alternate freezing and thawing. Paring away the diseased parts and covering the wound with a mud plaster will be found helpful. Some good tree paint applied to the trunks of trees will prevent in a great measure the injury.

As a result of my inspection of the orchards of the district I find that in many instances whole orchards have been set out to varieties not adapted to our locality or climate. These orchards can be remedied to a great extent by budding and top working to suitable varieties. The grower should find out what varieties are best suited to the market, and to his locality and then proceed to work over every undesirable kind that he has in the orchard. I have endeavored while around the orchards to learn

all those not acquainted with the process how to perform the work, and am pleased to see that some are engaged in changing these worthless kinds to suitable ones.

The time has arrived when we must determine upon a few suitable varieties of fall and winter apples. We are planting thoughtlessly, not giving that attention which the business is entitled to, and many orchardists are now paying the penalty by having thrown upon their hands a lot of worthless fruit with no market for the same. There are being propagated in our orchards to-day hundreds of varieties of apples and the grower can hardly explain why he is planting them. No study is given to adaptability, habit of tree, market value of fruit; in fact, it looks as though trees were simply being planted to see them grow. Certainly if Montana is to have a place in the list of apple producing states we must call a halt and settle down to two or three specially adapted apples.

Montana has to-day apples growing in her orchards that for size, quality, keeping and market, will rank with the best grown in any land. Yet growers will go on planting untried and tried worthless kinds, when they might profit by the experience of older heads if they would only look around for themselves.

I desire before closing this report to call the attention of the board to the importance of Missoula as a quarantine station for the inspection of nursery stock and fruits. Missoula is practically the key to all western Montana. Through it passes all the nursery stock that is used in the Fourth and Fifth districts and we cannot be too careful in the matter of inspection there. The importance of this point can readily be seen when we understand that there are set out in western Montana about 150,000 trees annually.

Respectfully submitted,

J. O. READ,
Member for the Fifth District.

To the Honorable State Board of Horticulture.

Sirs: Having been appointed deputy, or assistant inspector for the Sixth District and assigned the codling moth district embracing the city of Kalispell and vicinity surrounding the same, I herewith submit my report of the season's work.

Having no previous knowledge of the extent of the infested area, I decided to treat the entire city as one orchard, which in reality it is.

In making a house to house canvass and platting the door yard or city orchards, I found 4,742 fruit trees of all kinds growing on 339 city lots, of which 305 are apple, 1,074 cherry, 443 plums, 167 pears and 13 peach. Of this number 1,081 are apples and pears of bearing age.

Having prevailed upon the city council to pass a spray ordinance to aid me in my work, I commenced spraying June 7th and sprayed four times during the season. The first time sprayed I used paris green—4 oz. paris green and 2 lbs. lime to 45 gals. water. Owing to the frequent rains washing off the paris green spray, I secured and used for the remainder of the season arsenite of lead in a prepared form under the name of "disparene," prepared by the Bowker Insecticide Co., of Boston, Mass., at the rate of 3½ lbs. to 45 gals. of water. I find the arsenite all that is recommended for it, not only adhering to the fruit and foliage, but being effective not only for the codling moth, but destroying all biting insects.

In addition to spraying, when the larvae began to develop, all bearing trees were banded and the bands carefully examined once every two weeks, and all fruit found containing larvae was gathered and destroyed.

The windows of all store houses and cellars where fruit had been stored were covered with screen to prevent the flight of any moth which might develop in them.

All bearing trees were included in the first spraying, but as the season advanced and the moth began to develop, by close inspection and examined I was able to ascertain the exact extent of the infested area and sprayed only the infested district and those blocks immediately surrounding, or about 550 of the 1,081 bearing trees contained in the city.

Three orchards containing 69 of the largest trees in the city, in the center of the infested district, were selected and a record kept of the season's work, with the following results:

The first larvae to change to the pupa stage was found May 27th; first empty cocoon on June 9th; larvae of the first brood was found in the cocoons as late as July 14th.

By August 3d the moth could be found in all stages of development. On August 12, 90 per cent found under bands were in the pupa stage, while on the next examination all cocoons contained larvae, no pupa being found.

First examination of bands was made July 10th, when 8 larvae

was found. Second examination July 26th, resulting in 81 larvae and pupa. Third examination August 4th, giving 62 as results. Fourth examination August 13th, when 42 were found. Fifth examination August 17th, finding 4. Sixth examination August 26th, showing 9 under bands. Seventh examination September 4th, only 3 being found.

Had a careful record of the entire city been kept, I believe equal results would have been obtained. As the last two examinations clearly indicated that all larvae entered the bands would remain until next season, I have waited until all fruit was gathered before taking them off and destroying them. In a short time I shall remove them and report results.

In only three orchards beyond the city limits has the codling moth made its appearance, and these were treated in a similar manner to those within the city, with still more gratifying results. In one of them, which was badly infested a year ago, I found only seven larvae under bands, and those early in August, and I have every reason to believe in this one instance they have been exterminated.

My work in Kalispell allowed but little time for orchard work, and that time was devoted to orchards immediately surrounding the city. I inspected 37 orchards containing 20,729 trees. These orchards, as a whole, are in a thrifty, vigorous condition and, with the exception of green aphis and a few cases of pear leaf blister mite, are remarkably free from pests and disease.

For green aphis I recommended whale oil soap and quassia chips, and for the blister mite lime, salt and sulphur, while in a dormant condition.

Had I not been instructed to stop all orchard work, my intentions were to inspect all orchards within three miles of the city of Kalispell in order to ascertain if the codling moth had appeared beyond the city, as well as to show the number of trees endangered, should the work be stopped and the moth be allowed to spread.

But, as I was unable to complete that part of my work, I will make a conservative estimate and place the number at 50,000 within a radius of three miles of Kalispell.

From my experience and observation in Kalispell, I not only believe that by intelligent, thorough and careful work the codling moth cannot only be effectually controlled, but eventually exterminated in this district, and if necessary, all other orchard

work be stopped and the time and money devoted to that work; also, that the inspection laws governing fruit shipped in from other states and the destruction of empty fruit boxes be more rigidly enforced. Most respectfully,

J. C. WOOD,
Deputy Inspector Sixth District.

Big Fork, Mont.

Thompson, Mont., Nov. 9, 1904.

C. H. Edwards, Secretary of State Board of Horticulture, Butte, Mont.

Dear Sir: I herewith send a report of all work done by me for the season ending Nov. 1, 1904. In the months of March and April I sprayed 2,100 trees for oystershell bark louse. The formula used was lime sulphur and salt, one pound of each to three gallons of water. The results were very satisfactory; also found it good for pear leaf blister mite. In the months of June and July I sprayed several small orchards in Thompson for codling moth. The formula used was paris green and lime, but did not find it very satisfactory. In September I inspected the orchards at Plains. They were all in good condition with the exception of ten that had some oystershell bark louse, but think one more good spraying will eradicate them. As a general thing found all orchards in a very good condition.

GEO. S. GOOD,
Inspector Fourth District

Missoula, Mont., Oct. 25., 1904.

To the State Board of Horticulture.

Gentlemen: During the season of 1904 I have inspected a total of 2,419 packages of fruits and nine straight carloads of fruits. This is the first season that fruits have been shipped in straight cars to this point. I found it necessary to condemn but little fruit. During the season I inspected all the orchards in and around Missoula and sprayed a total of 3,368 trees. Two sprays were made, the first about June 30th and the last about the middle of August. I find it very difficult to carry on a systematic work against the codling moth at this point for the reason that the orchards are scattered over so wide a territory, which makes the work very expensive to carry on. However, I am satisfied that much good was accomplished this season. I find that many

owners of trees are becoming deeply interested and are anxious to assist in the work. During the spring and fall, in addition to inspecting home-grown nursery stock, I inspected and fumigated fifty-one shipments of nursery stock. I found it necessary to condemn several thousand trees on account of infection of crown gall and woolly aphis.

Respectfully,

E. M. TUCKER,
Inspector, Missoula.

CODLING MOTH.

Codling moth is an old enemy of the apple raising industry. It was imported in fruit from Europe to this country and has likewise extended to every country in which the apple is grown. Every apple state in the Union has the pest. It prevails in the railroad centers of Montana. No commercial orchards in the state are infested by it at the present time, but its gradual extension and spread is probable. With reasonable care on the part of orchard owners, however, and with a knowledge of the life history of the insect, years and perhaps decades should pass before the insect does extensive damage in the state.

Many of our orchards are isolated and at a distance from railroads. As the moth is known to fly not more than a mile, infestation of these will take place only through old fruit boxes or fruit, infected with the insect in the larval form. An orchardist should never permit old fruit boxes to be brought near his premises. Infection of his trees take place readily from them and once established in an orchard it is practically impossible to exterminate the codling moth.

The insect passes the winter in the larval condition, that is as the common apple worm, in durable cases made by it under the outer bark of trees, under rubbish or in the cracks of fences and even in the ground. In May pupation takes place and the adult moth emerges. It is a small insect with a wing expansion of about three-fourths of an inch. Careful search alone can discover them, even when abundant, at this stage of growth. The moth lingers around for a time and then, if evenings are warm, proceed to lay her eggs. These are deposited on the fruit or leaves of the apple and the pear. From fifty to one hundred and fifty eggs are thus laid and soon after the mother moth dies.

The eggs are about the size of the head of a pin, white or with a yellowish tinge. They hatch in from four to ten days. From them emerge minute larvae which wander around for some hours over the surface of the apples seeking a suitable place to start a tunnel for the center of the fruit. This is usually with the first brood, the calix end. About sixty per cent enter the apple from this place and the remainder enter from the sides or where two apples touch.

In all instances the young larvae prefers a protected location

to begin work on his tunnel. This selected he begins eating his way to the center of the fruit. He feeds upon the substance of the apple as he goes and pushes his castings out of the mouth of his tunnel. A week or less is spent by him in getting to the center. Here he feeds upon the seeds and fills the chamber with his castings. He remains here ten to thirty days and grows rapidly in size. When nearly full grown he makes another tunnel to the surface. The mouth of this tunnel is often at the calix

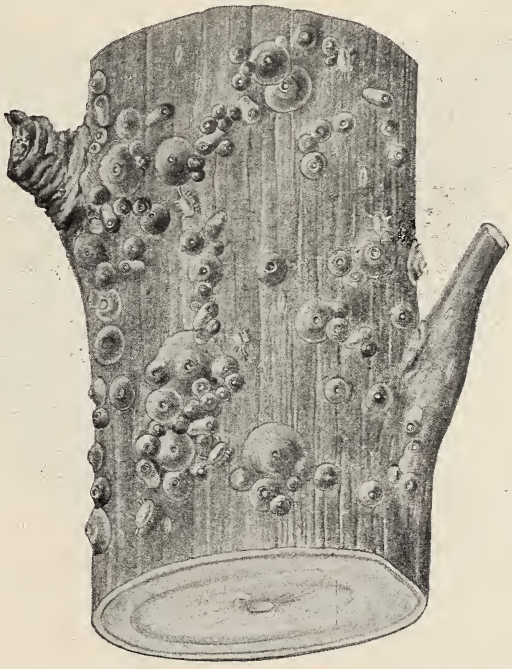


FIG. 1.—Twig with San Jose Scale magnified five times.
—By Permission of Virginia Crop Pest Commission.

but oftener in the side of the apple. For several days this exit hole is kept closed by a web spun by the insect and by castings. These are pushed out by the insect when it leaves the fruit.

The apple at this stage may or may not have fallen from the tree. In any event the larvae of the first brood on emerging from the apples looks for a suitable place to undergo transformation into a moth. Some crawl back to the limbs and trunks, some let themselves down by threads to the ground and reascend the trunk. In all instances a protected location is secured which may be under outer bark, in crevasses of the tree, under bands, on rubbish about the tree and possibly in the ground.

A silken cocoon is spun by the larvae. In about three days it becomes a pupa. In this state he remains two or three weeks. At the end of this period he comes out again a moth. The females again lay their eggs and a similar round of life is completed. This last brood spend the winter in the larvae state in cocoons made much securer and stronger than those constructed by the first brood.

In Montana the insect produces two broods annually. These

FIG. 2.—Leaf of Apple, showing San Jose Scale about natural size.
—By Permission of Virginia Crop Pest Commission.

are very irregular in the time of appearance, due to the long period during which eggs are deposited by the first moths. At the end of summer exists on this account an overlapping of broods, and in August the insect may be found in all stages of development.

Remedies.

Spray within ten days after the blossoms fall, with paris green

and lime or arsenate of lead. Spray again a month later with the same preparations. These earlier sprays are liable to be quickly washed away by rain. From August 15 to September 15 the larvae are most abundant and rains less and sprays at this time are most effective in this state. Banding is another method for fighting the pest. Bands of burlap are tied around the trunk and large limbs and visited once a week and the larvae

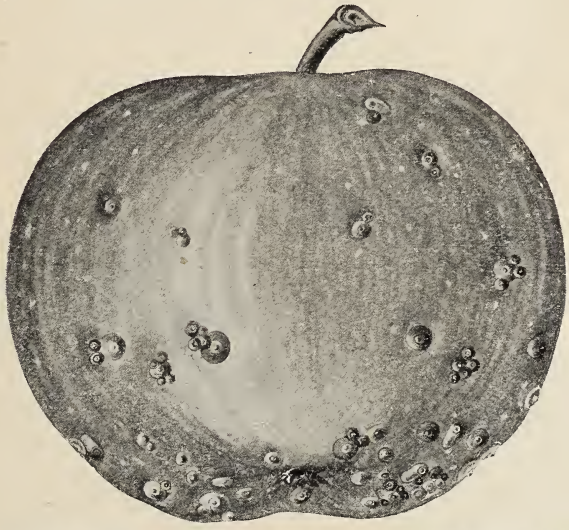


FIG. 3.—Apple infested with San Jose Scale, slightly magnified.
—By Permission of Virginia Crop Pest Commission.

destroyed. Banding can well be used to supplement spraying, but the latter is most effective.

CROWN GALL.

The attention of all nurserymen and orchardists should be called to the destructive and persistent nature of the disease known as Crown Gall. It has been introduced into Montana on nursery stock, has done extensive damage to orchards already, and is the chief pest of the young apple orchard.

The disease may be known by swellings of a porous irregular warty structure at the crown of the tree, most frequently where stock and scion are united. It is, however, not merely a trouble of grafted stock. It affects seedlings as readily as smaller galls are often present on the roots. The swellings at times attain the size of the fist, but on young trees in Montana, are usually much smaller. They disintegrate readily in the soil and pul-

verize more or less in drying. They have often been mistaken for the galls caused by woolly aphis. The latter are smoother and more oval and are comparatively rare in Montana.

The galls are caused by a slime mould fungus, closely related to the fungus that causes club root of the cabbage. It is primarily a nursery disease. In the nursery row it spreads with great rapidity and when once the germ is introduced stock cannot safely and profitably be grown for several years on the infected plot of ground.

Any young tree infected with Crown Gall is worthless and should be destroyed by burning. All purchasers of young trees should be sure before accepting them that the roots have no galls of any kind.

The presence, in a shipment of trees, of a few with Crown

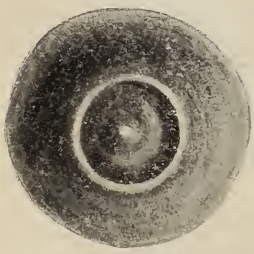


FIG. 4.—Half-grown Female.

FIG. 5.—Full-grown Female.

—By Permission of Virginia Crop Pest Commission.

Gall upon them, subjects the remainder of the trees to grave suspicion and perhaps warrants the rejection of all.

No young tree so affected will grow and mature fruit in paying quantities. If death occurred at once after planting, the loss would not be so serious. But usually a tree affected with Crown Gall makes an abnormally slow growth during two to five years from the nursery, only to die at the end of that period. Thus its owner loses not only the original cost of the tree, but also the use of the ground for a term of years, the cost of cultivation and all profit in the enterprise.

But by planting of trees affected with Crown Gall, worst of all, the orchardist introduces into his orchard an insidious and highly contagious disease. If new and healthy trees are planted in the same plot it readily communicates itself to them. Especially

is this the case in cultivated or in irrigated ground. The germ is readily distributed by the cultivator and by water flowing from one tree to another.

Crown Gall attacks apple, pear, peach, plum, apricot, nectarine, quince, cherry, poplar, blackberry and raspberry.

No method of alleviating or remedying the trouble is known. When nursery stock is so diseased it should be burned and when a young orchard is badly affected, the cheapest method to pursue is to use the land for something else than trees for a long time. The germ will persist in the soil in the absence of trees about four years.

OYSTERSHELL BARK LOUSE.

This is one of the few scale insects that are found out of doors in the state. It was brought here on nursery stock and has established itself at Plains, Selish, Lo Lo and at Flathead Lake.

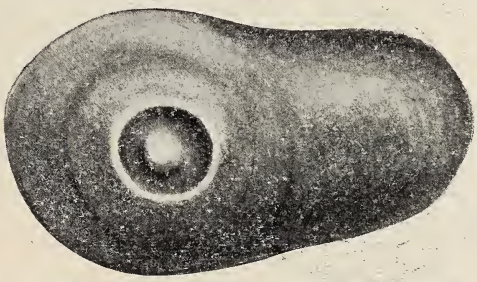


FIG. 6.—Full-Grown Male.—All much enlarged.
—By Permission of Virginia Crop Pest Commission.

In orchards at these places it seems to flourish and to spread, and becomes a serious detriment to successful apple raising.

The insect passes the winter in the egg form under the protection of its scale. Sometimes in June, probably, though the time will vary and each year must be determined, the young emerge from the eggs and crawl along the limbs. After a day of migratory life they become fixed and by their secretions form the characteristic scales. The scale of the female is oyster-shaped, of a purplish brown color and about one-twelfth of an inch in length. The scales sometimes cover thickly the trunk branches and even the fruit of the tree.

Oystershell bark louse attacks willow, pear, plum, quince, poplar, currant, raspberry, rose and wild cherry as well as apple.

Remedies.

In the dormant period when all leaves are off the tree spray with lime, sulphur and salt. In the summer when the young are migrating, spray with kerosene emulsion ten times diluted.

PEAR BLIGHT.

By Dr. B. T. Galloway.

In parts of California, Oregon, Montana and Washington where this trouble has shown itself, and, fortunately, they are not many, the following explicit account of pear blight by Dr. B. T. Galloway, Chief of the Division of Vegetable Physiology and Pathology of the Department of Agriculture, will be read with

FIG. 7.—Old Female Exposed.
—By Permission of Virginia Crop Pest Commission.

much interest. In pear orchards, where the disease is unknown, it should be always looked for, and the grower will be glad to know what to look for.

What the blight is—Pear blight is a contagious bacterial disease of the pear and allied fruit trees. It attacks and rapidly kills the blossoms, young fruits and new twig growths, runs down in the living bark to the larger limbs and thence to the trunk. While the bacteria themselves rarely kill the leaves, at most only occasionally attacking the stems and midribs of the younger ones, all the foliage on the blighted branches must, of course,

eventually die. The leaves usually succumb in from one to two weeks after the branch on which they grow is killed, but remain attached and are the most striking and prominent feature of the disease.

How it acts—The most important parts of the tree killed by the blight are the inner bark and cambium layer of the limbs and trunk. Of course, when the bark of a limb is killed, the whole limb soon dies, but where the limb is simply girdled by the disease, it may send out leaves again the next season and then die. All the parts of the tree below the blight are healthy, no more injury resulting to the unaffected parts of the tree than if the blighted parts had been killed by fire or girdling.

The cause—The blight is caused by a very minute microbe of the class Bacteria. This microbe was discovered by Prof. T. J.

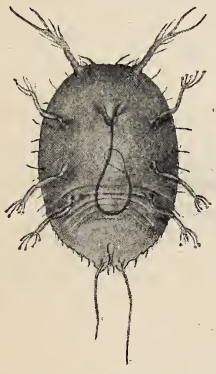


FIG. 8.—Young Scale Insect, enlarged 125 times.

FIG. 9.—Mature Female Insect, much enlarged.

—By Permission of Virginia Crop Pest Commission.

Burrill in 1879 and is known to science as Bacillus amylovorus. The following are the principal proofs that it caused the disease:

1. The microbes are found in immense numbers in freshly blighted twigs.

2. They can be taken from an affected tree and cultivated in pure cultures, and in this way can be kept for months at a time

3. By inoculating a suitable healthy tree with these cultures the disease is produced.

4. In a tree so inoculated the microbes are again found in abundance.

Treatment..

The treatment of the disease may be classed under two heads:

1. Methods which aim to put the tree in a condition to resist blight or to render it less liable to the disease.

2. Methods for exterminating the microbe itself, which is of first importance, for, if carried out fully, there can be no blight.

The methods under the first head must, unfortunately, be directed more or less to checking the growth of the tree, and, therefore, are undesirable except in cases where it is thought that the blight will eventually get beyond control of the orchard. Under the head of cultural methods which favor or hinder pear blight, as the case may be, the most important are pruning, fertilizing, cultivation and irrigation; but details in regard to these need not be given here, as the main reliance must be placed in the only

FIG. 10.—Winged Male, much enlarged.
—By Permission of Virginia Crop Pest Commission.

really satisfactory method of controlling the disease—that is the extermination of the microbes which cause it. Every particle of blight should be cut out and burned while the trees are dormant, not a single active case being allowed to survive the winter in the orchard or within half a mile or so from it. Every tree of the pome family, including the apple, the mountain ash, service berry and all the species of Crataegus, or hawthornes, should be examined for this purpose, the blight being the same in all.

Cutting out blight—The orchardist should not stop short of absolute destruction of every case, for a few overlooked may go a long way toward undoing all his work. Cutting out the blight may be done at any time in the winter or spring up to the period

when growth begins. The best time, however, is undoubtedly in the fall, when the foliage is still on the trees, and the contrast between that on the blighted and that on the healthy is so great that it is an easy matter to find all the blight. It is important to cut out blight whenever it is found, even in the growing season. At that time of year, however, it cannot be hoped to make much headway against the blight, as new cases constantly occur which are sufficiently developed to be seen when the cutting is done. In orchards where there are only a few trees and the owner has sufficient time to go over them daily, he will be able to save some which would otherwise be lost. However, when the trees stop forming new wood, the campaign should be begun in earnest.

Examinations for blight—Of course, the greater part of the blight can be taken out the first time the trees are gone over. If this should be in midsummer, the trees should be all again carefully inspected in the autumn, just before the leaves shed, so as to get ever case that can be seen at that time. After this a careful watch should be kept on the trees, and at least one more careful inspection given in the spring before the blossoms open. It would, doubtless, be well to look the trees over several times during the winter, to be certain that the blight is completely exterminated. In order to do the inspecting thoroughly it is necessary to go from tree to tree down the row, or, in the case of large trees, to walk up one side of the row and down the other, as in simply walking through the orchard it is impossible to be certain that every case of blight has been cut out.

The above line of treatment will be even more efficacious in keeping unaffected orchards free from blight. A careful inspection of all pomaceous trees should be made two or three times during the summer, and a sharp outlook kept for the first appearance of the blight. It usually takes two or three years for the disease in an orchard to develop into a serious epidemic, but the early removal of the first cases will prevent this and save a great deal of labor later and many valuable trees.

BUD MOTH.

When the buds of fruit trees begin to swell in the spring, they are frequently attacked by a small worm, the larvae of the bud moth. Apples, cherries, pears and plums are injured by it

in this state in the localities where the pest has become established.

The larvae is, in the spring, about a quarter of an inch long, with a dirty white body and a dark brown head.

It feeds on the opening buds and later ties together leaves or blossoms forming a case, in which it lives securely protected, venturing forth only to feed. In this case, it grows to nearly three-quarters of an inch in length, pupates and emerges about the middle of July as a moth. The moth lays her eggs, out of which the young larvae soon hatch and feed on the leaves. When partially grown they spin, in protected situations, nests for win-

FIG. 11.—Last Segment of Female San Jose Scale.
—By Permission of Virginia Crop Pest Commission.

ter quarters. These are usually attached to the bark of the host tree and are very inconspicuous. It is in these winter cases that they are distributed on nursery stock.

At times in other states the bud moth has become a pest of the first class. Ordinarily when abundant its ravages are especially noticeable only on young trees, which it is liable to deform.

Remedies.

Spray with arsenate of lead just before and after the buds open. Paris green and lime may also be used, but is not as effective. Or spray with lime-sulphur just before the buds begin to swell.

APHIS.

For aphis of all kinds and the apple aphis in particular, use lime-sulphur spray during the dormant period of the tree. In all probability this spray will prove most effective applied as late as possible in the spring, just as the buds are swelling. This is probably the most effective remedy for aphis known. Quassia

chips and whale oil soap or kerosene emulsion, according to formula given, should be applied preferably before and after the buds swell in the spring. Later applications are not so effective.

Aphis of different species attack most all our orchard and shade trees. In 1902 they did extensive damage throughout the state. "Aphis years" are liable to occur again. Even in ordi-

FIG. 12.—Stem Colonies of Woolly Aphis.

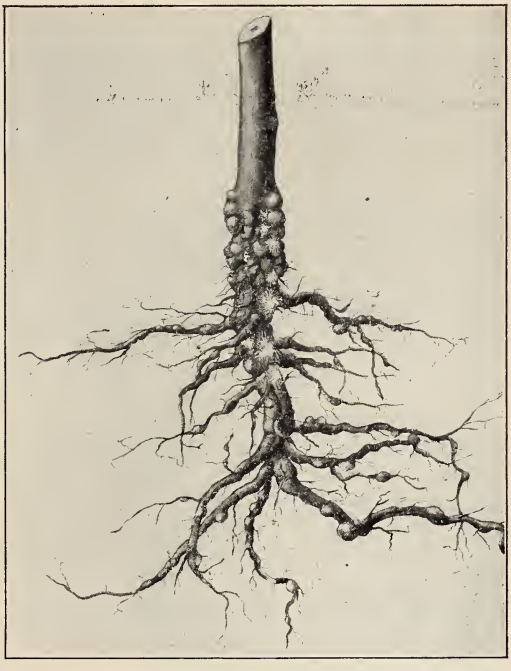


FIG. 13.—Crown and Root of Young Apple Tree, showing characteristic swellings or galls produced by the root lice.

—By Permission of Virginia Crop Pest Commission.

nary years the pests are destructive. Their variability in numbers makes accurate observation of the effectiveness of sprays difficult, but experiment and practical experience seems to warrant the extensive use of the lime-sulphur solution for these insects.

SAN JOSE SCALE.

The San Jose scale has not yet been found in Montana. Notwithstanding the inspection and fumigation of nursery stock, it

will probably at some time gain a foothold. This insect has proved very destructive to trees of all kinds in other states, and more than any other pests called attention to the loss occasioned by injurious insects and fungi. Its course was at first unchecked, but later more efficient methods of treating infested trees have removed the dread of its presence. Probably it will never prove a serious pest in Montana, and if it ever becomes established, can be easily controlled by the lime-sulphur solution.

PEAR LEAF BLISTER MITE.

The leaves of pear trees are often disfigured by brownish blotches raised and with a small hole in the center of the eleva-

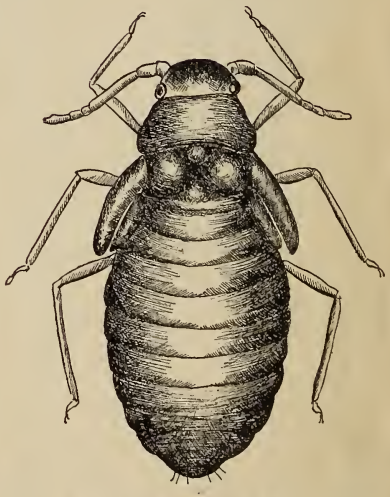


FIG. 14.—Agamic Female of Woolly Aphis, much enlarged.

FIG. 15.—Pupa of Woolly Aphis, much enlarged.

—By Permission of Virginia Crop Pest Commission.

tion. These blotches are small, but often run together and later turn black, destroying in part or wholly the functions of infected leaves. The trouble is the work of a small mite, which burrows beneath the epidemis of the leaf and propigates rapidly.

The mite is easily controlled by lime-sulphur applied late as possible in the spring, but before the buds have burst.

WOOLY APHIS.

This insect is a small plant louse, wingless or winged. Its body is covered with a filmy woollike secretion which projects beyond the rear of the body. They form conspicuous white patches in depressions on the bark of apple trees, most frequent at the base.

This insect affects both the roots and trunk and is one of the most prevalent and injurious foes of the apple. The damage done by them above ground is insignificant, but below ground

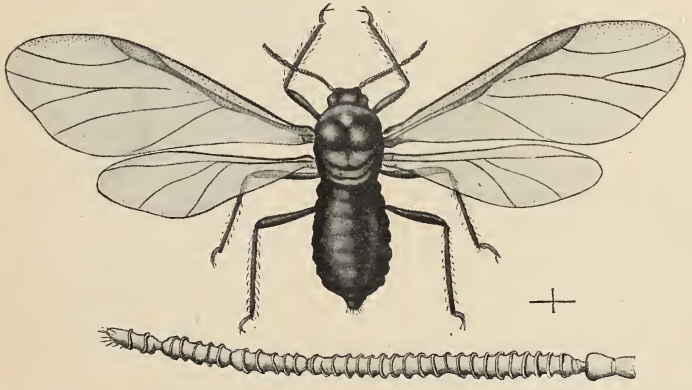


Fig. 16.—Winged Agamic Female of Woolly Aphis, much enlarged.
—By Permission of Virginia Crop Pest Commission.

they cause galls on the roots which seriously impare their functions. Older trees affected by them show devitalization, a yellow tinge of leaves which often fall prematurely. Younger trees are frequently killed by them.

This pest is distributed on nursery stock and purchasers of apple trees should be on the watch for the galls on the roots or the white secretion on the bark. It is very common on imported stock and may escape, if not abundant, the observation of an inspector, and it is not killed by fumigation. It occurs in a few orchards of the state.

Scions on Northern Spy stock are very resistent to the attacks of woolly aphis.

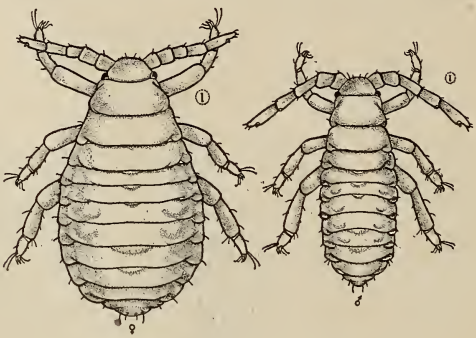
Remedies.

Destroy all young trees, the roots of which have any number of

galls upon them. This is a measure of safety in our state which suffers at the present time little from the ravages of this insect.

If stock is suspected dip in tobacco water or in hot water, 130 F. Kerosene emulsion diluted ten times will also serve.

When older trees in the orchard are infested, wood ashes or tobacco dust thrown around the roots will prove of material benefit. Or remove the soil from the base and, after soaking galls with hot water, replace the earth. Spray the aerial form with kerosene emulsion or, better yet, with lime-sulphur.



Female. Male.

FIG. 17.—Mature Sexual Individuals of Woolly Aphis, greatly enlarged. —By Permission of Virginia Crop Pest Commission.

INSECTICIDES AND FUNGICIDES.

Insecticides may be divided into three classes according to the character of pests against which they are designed to be used. First, poisons that kill sucking insects. Second, poisons that kill leaf-eating insects. Third, poisons that kill fungi.

Sucking insects insert their beaks into the tissues of leaf or bark and suck the plant juices. A spray must be applied to the surface of plants and the poison remains on the surface as the water dries. The beak of a sucking insect goes through this and through the outer layer of the plant. No amount of stomach poisons can, therefore, injure them. Such insects are scale insects and plant lice. Never use arsenicals like paris green against these insects.

For sucking insects of this type a contact poison must be used. Kerosene oil, whale oil soap and quassia chips are poisons of this character. They operate by closing the breathing apparatus or by penetrating the skin.

Arsenicals are used where the injurious insect is leaf-eating or

leaf-chewing. The potato beetle, codling moth or tent caterpillars are instances.

Paris Green.

Arsenic uncombined is injurious to foliage and in paris green it is combined with copper. Even in properly made paris green there is a small percentage of uncombined arsenic and this often burns foliage if applied in strong or even weak solutions. To obviate this a little freshly slacked lime is added to the paste of paris green before the full quota of water is added.

Paris Green Formula—Paris green, one pound; freshly slacked lime, one pound; water, one hundred and twenty-five gallons.

Make a paste of the paris green with a little water. Add lime to the paste, mix thoroughly and pour in required amount of water. The mixture must be agitated while in use as paris green

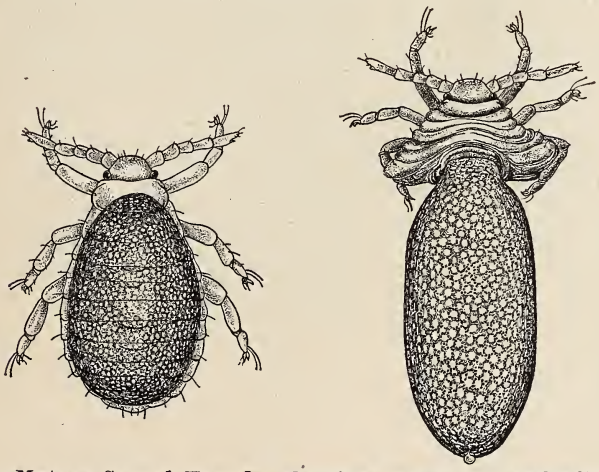


FIG. 18.—Mature Sexual Female, showing egg before and after extrusion—greatly enlarged.
—By Permission of Virginia Crop Pest Commission.

is but slightly soluble in water and the small granules sink readily to the bottom of the vessel.

Arsenate of Lead.

This substance is formed from the union of arsenate of soda and acetate of lead. Dissolve four ounces of arsenate of soda in a gallon of water. Also dissolve eleven ounces of acetate of lead in another gallon of water. Mix the two solutions together and stir into one hundred gallons of water.

Preparations of arsenate of lead are for sale by the Bowker Insecticide Co., Boston, Mass., and Wm. H. Swift, Boston, Mass.

Arsenate of lead is rapidly coming to the front as an arsenical insecticide. It does not burn foliage even when applied in strong mixtures. Its presence is manifest when sprayed on a tree by its white color and it adheres better and longer than paris green. Its use is advised for codling moth in this state, in all the earlier sprays.

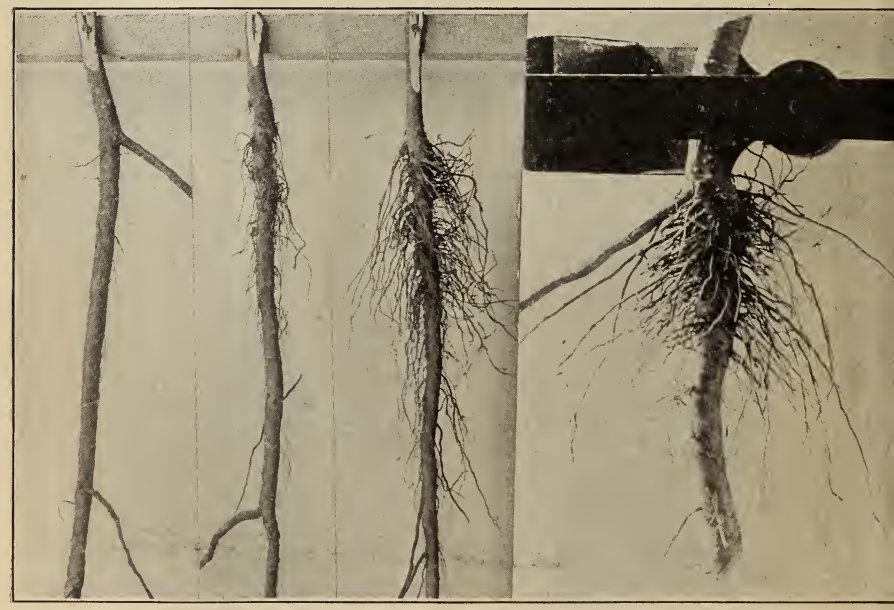


FIG. 19.—Healthy and Diseased Roots of Apple Seedlings. (Photo.) —By Permission of Virginia Crop Pest Commission.

Lime and White Arsenic.

White arsenic.....1 pound.
Lime .....2 pounds.
Water .....2 gallons.

Boil for an hour. At the end of this time the arsenic will have united with the lime. When wanted for use dilute with water and lime. The pound of arsenic is sufficient for 300 gallons of water.

CONTACT INSECTICIDES, FOR INSECTS THAT SUCK.

Kerosene Emulsion.

Place two gallons of ordinary kerosene in a warm place, either in a warm room or in the sun, and allow it to be come as warm as possible without danger from fire. Boil one pound of laundry

or whale oil soap in a gallon of soft water until completely dissolved. Remove the soap solution from the fire, and while still boiling hot, add the kerosene and agitate for ten minutes, or until the oil is emulsified, with a spraying pump by forcing the liquid back into the vessel from which it was pumped. When the liquid is perfectly emulsified it will appear creamy in color

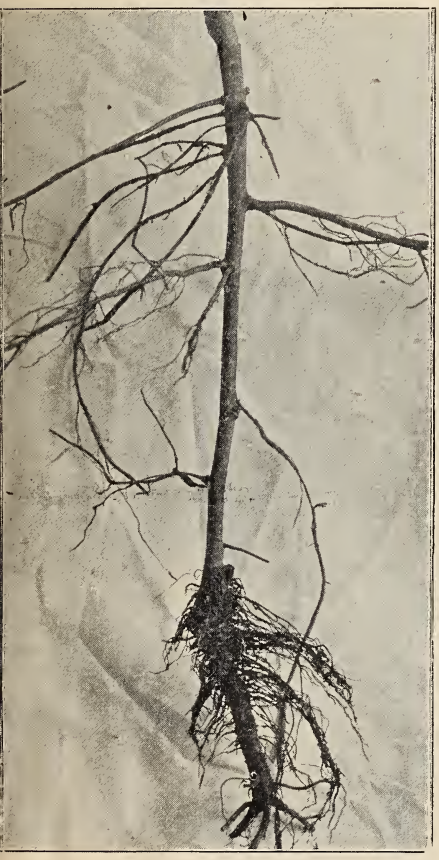


FIG. 20.—One-year Graft on Diseased Apple Root. (Photo.)

FIG. 21.—One-year Graft on Healthy Apple Root, inoculated with Crown Gall. (Photo.)

—By Permission of Virginia Crop Pest Commission.

and will flow evenly down the side of the vessel when allowed to do so. Care should be taken to completely emulsify the oil, and this is accomplished much more easily when the mixture is hot. This strong emulsion may now be readily diluted with water and used, or it may be stored away for future use. When

cold it becomes like sour milk in appearance and should be dissolved in three or four times its bulk of hot water before diluting with cold water. If the water is at all hard, "break" it by adding a little salsoda before putting in the soap.

Small amounts of this emulsion may be made by using the ingredients in small quantities, but in the same relative proportion.—Bulletin No. 24, Agricultural College, Michigan.

FIG. 22.—Crown Gall of Apple on Nursery Stock. (Photo.)
—By Permission of Virginia Crop Pest Commission.

Whale Oil Soap and Quassia Chips.

Boil for two hours one pound of quassia chips in water. Dissolve in warm water one pound of whale oil soap. Mix the two solutions and use in six gallons of water. Most effective spray for summer use against aphis.

Lime-Sulphur Salt.

Formula:

Lime .....15 pounds.
Flowers of sulphur.....15 pounds.
Salt .....15 pounds.
Water .....50 gallons.

Slack the lime thoroughly with hot water. Add enough water to make a thin whitewash. The sulphur and salt are then stirred in. Boil for one-half an hour adding water from time to time to prevent burning and stirring the mixture occasionally to prevent caking. Then add the requisite amount of hot water, or if cold water is added, bring the whole to the boiling point. Strain into the spray tank and apply hot to the trees with a fine nozzle.

This is the ordinary method of using lime sulphur and salt. When the spray was first used, the mixture was boiled for several hours. Now thirty minutes is considered sufficient. The salt is also omitted and gives no additional merit to the mixture.

In practical use in this state is the following formula, which has proved apparently as effective as the regular formula and is much simpler in preparation:

Sulphur .....20 pounds.
Lime .....20 pounds.
Water .....50 gallons.

Place the lime in a bucket and add to it boiling water. With hot water make a paste of the sulphur. When the lime is in full ebullition, add the sulphur paste. Slack the lime slowly, but add enough hot water to keep it from burning. When the lime is thoroughly slacked strain it into the spray barrel with the requisite amount of hot water. Thoroughly stir and apply to the tree with a Vermorel nozzle.

This does not do away with the boiling of a large quantity of water, but in many ways simplifies the preparation of the wash.

The following preparation, taken from Bulletin 247, N. Y. Ag. Ex. Station, Geneva, is recommended for experimental use in this state. It is prepared with cold water:

The Lime-Sulphur-Caustic Soda Wash.

Formula:

Lump lime .....30 pounds.
Flowers of sulphur .....15 pounds.
Commercial caustic soda.....4-6 pounds.
Water .....50 gallons.

Place the full quantity of lime in the kettle or barrel, or whatever the receptacle may be, and start it to slake with water, using

FIG. 24.—Black Knot of Plum and Cherry. (Photo.. —By Permission of Virginia Crop Pest Commission.

enough to prevent the lime from being air-slaked, and not enough to drown it. As soon as the boiling action commences, add the sulphur, which has just previously been made into a

paste with water. Stir this in thoroughly and pour in water in small quantities, to keep the mixture in the form of a rather thin paste. After the slaking of the lime, then add the caustic soda, in lots of about two pounds, at short intervals, and stir till the soda is dissolved. As soon as the chemical action has ceased, dilute the mixture with cold water to make the required amount. The time of cooking will be shortened by using warm water in slaking the lime, and in making the sulphur into a paste. This wash is advised for experimental purposes, or when it is not possible to use the sulphur wash prepared by external heat.

Use the same grades of lime and sulphur, flowers of sulphur preferably, as for the lime-sulphur-salt wash. For extensive spraying, purchase from wholesale druggists the commercial caustic soda, put up in fifty pound cans. Upon exposure to the air, the caustic soda absorbs moisture and greatly increases in weight. Odd amounts of the soda may be kept dry in covered Mason jars. To prepare small quantities of the wash one may use any of the common soda lye brands, as sold by grocers.

Any of the lime-sulphur formulae are very corrosive, and all spray pumps and attachments must be thoroughly washed after every use of them with this mixture. Its application is attended with great discomfort. It blisters hands and face. Rubber gloves will prove of service and vaseline or veiling, or both, may be used to protect the face. The pump and horses should always, if possible, be kept to windward as the continual blowing of the spray upon the latter will make their hair come off.

Lime of sulphur is the best insecticide known. It is destructive to a number of insects injurious to trees and in addition possesses a fungicidal value. Its extensive use is recommened in this state for oyster shell bark louse, and all other scale insects, for red spider and the clover mite, for aphis of all kinds, and pear leaf blister and for the bud moth and case bearer.

Lime sulhpur should be applied to the dormant tree in winter or early spring, never to foliage. It is effective in two ways, by its caustic properties, and by its poisonous qualtities. The first makes it effective against aphis by preventing the hatching of the eggs; the poisonous qualities are manifest with oyster shell bark louse. Any young insects that settle on a well sprayed tree die after a few days.

Fungicides—Bordeaux Mixture.

All things considered the best results will be obtained from the use of what is known as the fifty-gallon formulae of this preparation, as follows:

Ingredients:

Water	50 gallons.
Copper sulphate	6 pounds.
Unslacked lime	4 pounds.

Must be well made—It has been found that the method of combining the ingredients has an important bearing on both the chemical composition and physical structure of the mixture. For example, if the copper sulphate is dissolved in a small quantity of water and the lime milk diluted to a limited extent only, there results, when these materials are brought together, a thick mixture, having strikingly different characters form one made by pouring together weak solutions of lime and copper sulphate. It is true, furthermore, that if the copper sulphates solution and lime milk are poured together while the latter, or both, are warm, different effects are obtained than if both solutions are cool at the moment of mixing. Where the mixture has been properly made there is scarcely any settling after an hour, while the improperly made mixture has settled more than half.

How to make it—Briefly, the best results have been obtained from the use of the bordeaux mixture, made in accordance with the following directions: In a barrel, or other suitable vessel, place twenty-five gallons of water; weigh out six pounds of copper sulphate, then tie the same in a piece of coarse gunny-sack and suspend it just beneath the surface of the water. By tying the bag to a stick laid across the top of the barrel no further attention will be required. In another vessel slack four pounds of lime, using care in order to obtain a smooth paste, free from grit and small lumps. To accomplish this it is best to place the lime in an ordinary water pail and add only a small quantity of water at first, say a quart or a quart and a half. When the lime begins to crack and crumble and the water disappear add another quart or more, exercising care that the lime at no time gets too dry. Towards the last considerable water will be required, but, if added carefully and slowly, a perfectly smooth paste will be obtained, provided, of course, the lime is of good quality. When the lime is slacked add sufficient water to the paste to bring the whole up to twenty-five gallons. When the copper sulphate is

entirely dissolved the lime is cool, pour the lime milk and copper sulphate solution slowly together into a barrel holding fifty gallons. The milk of lime should be thoroughly stirred before pouring. The method described insures good mixing, but to complete this work the barrel of liquid should receive a final stirring for at least three minutes with a broad wooden paddle.

TOP WORKING ORCHARD TREES.

By G. Harold Powell,
Assistant Pomologist, Bureau of Plant Industry.

Introduction.

The top working of orchard trees is concerned with the insertion of buds or scions in the tops of the trees after they are established in the orchard. It may be practiced upon trees of bearing age which it is desirable to transform into better sorts; or it may refer also to trees recently planted which may be top-worked for other purposes. The fruit grower may have planted varieties that are not adapted to his climatic conditions, or when the orchard reaches bearing age, may find that the varieties are not true to name, and are inferior or even worthless. In many of the orchards that were planted about twenty-five years or more ago, especially in the Southern states, the trees are of varieties that were brought from sections having entirely different climatic conditions, and as they are not adapted to the South, the orchards have been unprofitable. Under any of the conditions mentioned, it may be possible to convert the orchard into a paying investment by top working the trees with buds or scions of better kinds, and it is this form of top working that is most widely known and practiced. Top working may be useful also in building up broken down tops of highly prized trees. It may be employed in grafting varieties into the tops of self-sterile trees to insure cross pollination. It may be practiced in re-forming the tops of trees like the peach, and it is especially useful in testing new varieties by bringing them into early bearing by top working them into bearing trees.

There are many varieties of orchard fruits desirable for commercial orchards or for domestic use that are lacking in hardiness or vigor. The trees may be susceptible to sun scald or to insect troubles, and are short-lived and unproductive when propagated in the usual manner. With a view to correcting these difficulties, orchards are sometimes planted with a single hardy, vigorous, straight-growing, long-lived variety. A year later, or as soon as the trees are well established and growing strongly, selected buds of the permanent varieties are grafted or budded in the body or branches, and the original tops are removed as soon

as the new buds start into growth. This method of establishing an orchard by double working is growing in favor, especially with apple growers who wish to provide some desirable quality through the stock not found in the body of the permanent variety, or to grow an orchard from buds taken from trees of superior merit.

To Lessen Injury From Sun Scald.

Sun scald is a climatic disease. It is especially serious on apples in the Mississippi Valley, the Ozarks, the Prairie and Northwestern states, and in the most Northern apple regions of the East..

Pears, especially the Kieffer, cherries, plums, and occasionally peaches are injured also, but to a less extent. Sun scald is induced by warm spells of weather in the late winter and spring months, when the sun, shining on the South and West sides of a tree, causes the body and the larger branches to start into premature growth. If cold weather again sets in, the active parts of the body and sometimes of the large branches are killed. The bark and living tissues dry and adhere to the wood and crack open and separate from the body during the succeeding summer. The tree is finally weakened by bacteria and fungi, which cause the body to decay. It then either dies or is blown over.

The sun scald is most severe when there are violent alterations in temperature in the spring, accompanied by high winds, and it is especially disastrous when the ground is frozen so deeply that the tree can not absorb sufficient water to replace the moisture lost by evaporation.

Varieties differ in their susceptibility to sun scald, though the kinds apparently exempt in one locality may succumb to it in a more severe climate. Occasionally there may be winters when not only all of the young apple orchards but even some of the young forest trees in exposed places are affected. In New York and New England the Northern Spy, Roxbury Russett, Tolman and Arctic are among the least susceptible, while Tompkins King, Twenty Ounce, Esopus, and Gravenstein are most often affected. In Ottawa, Canada, the Haas, McMahon, Wealthy, Oldenburg, and Gideon are seldom attacked, while nearly all of the New York and New England kinds are injured. Some of these varieties, however, like Northern Spy, have been grown successfully on these hardy, resistant stocks, where a hardy root was also provided. In the Mississippi Valley and the Ozarks the

Ben Davis, Gano, Missouri Pippin, and Ralls are frequently attacked, while Limbertwig, Winesap, York Imperial, Grimes, Jonathan, and Greyhouse (Hoopes) are freer from it.

It is possible, therefore, to reduce the danger from sun scald by top working a susceptible sort on a variety that has proved more resistant to the disease. The selection of the stock depends on the behavior of the varieties in each locality. In addition to its resistance to the disease the stock should be equally vigorous in growth with the variety to be worked upon it.

Besides the selection of resistant stocks, the danger from sun scald can be reduced to a minimum by starting the top of the tree close to the ground, and by inclining the tree to the southwest. The branches thereby shade the body of the tree. It is possible also to prevent scald by the use of mechanical shading devices, such as lath, wire, or board screens, by wrapping the trunk with a flexible material like straw, to be removed in summer, or by inclosing the body in a box filled with earth.

To Modify Vigor.

There is a nice balance between the roots, the stem or body, and the top of the tree, and each part has a strong influence on the vigor of the other two. The slow-growing quince root, the doucin and paradise apple, and the mahaleb cherry and sand cherry reduce the normal vigor of the pears, the apples, the cherries, and the plums worked upon them, and make dwarfing or semidwarfing possible. The Northern Spy, Ben Davis, and Fallawater apples, all strong-growing varieties, develop an unusually vigorous root system in the stocks on which they are worked. In a similar way a strong-growing body invigorates both the top and root system of the tree. The Jonathan, Wealthy, Oldenburg, Esopus, and Red Canada apples are thrifty, but of slender growth, and all of them partake of the vigor of Northern Spy when top-worked on it.

In a similar manner the slender-growing cherries are made stronger when worked on the vigorous mazzard stocks. Pears are invigorated when worked on stronger growing bodies, and it is a common practice in some nurseries to double-work slender-growing varieties like Bosc, Winter Nelis, Barry, Wilder, and Danas Hovey or strong-growing bodies like Kieffer and Bartlett. Slender-growing plums, like Lincoln, are greatly strengthened when top-worked on the vigorous Marianna, and the Japanese chestnut is invigorated when worked on the American species.

Top-working therefore becomes an important factor in making slender and weak-growing but otherwise desirable varieties of greater value. A striking example of the influence of a strong stock on a less vigorous variety is found in the Red Canada apple, which, under the name Steele's Red Winter, was extensively worked on seeding stocks in Wayne County, Mich., in the early history of apple growing there, sixty-five or seventy years ago. Under these conditions the variety was vigorous, prolific, a long keeper, and popular in the markets of the West. It was therefore propagated widely in the nurseries, but, when grown upon its own body, the trees were slow and weak in growth. For this reason the variety, when grown from nursery-propagated trees, was generally condemned, and was commerically obscured for many years. But in the orchard in which the variety happened to be grafted on Northern Spy, or Tolman, it still retained the old-time vigor and productiveness of the early orchards that were top-worked on strong-growing seedlings. At the present time the variety is regaining its former prestige in Michigan, where its commercial value depends on top-working it on a strong-growing variety.

To Modify Insect Injuries.

The wolly aphis (Schizoneura lanigera Hausm.), known in foreign countries as the "American blight," attacks the roots bodies, and tops of many varieties of apple. On the roots of nursery stock it is particularly disastrous, as it is most difficult to control in that position. On the trunk and top it is more easily subdued. All varieties are not equally attacked. In England first, and later in Australia, it was observed that the Winter Majetin was practically immune, and still later, when American apples were introduced into Australia, the Northern Spy was found resistant. Australian and some Western American nurserymen now offer lists of "blight-proof" stocks, on which the commercial varieties are propagated, and by their use the damage by the wolly aphis, which was a scourage to the apple industry of Australia, has been reduced to a minimum. The varieties are worked either upon the roots of the resistant stocks, or top-worked upon their own rooted trees.

Methods of Obtaining a Self-Rooted Tree.

There are several practical ways of establishing a fruit tree on its own roots. Kieffer pears, Marianna plums, and most myrobolan plum seedlings, as well as some of the Japan plums, like

Satsuma, may be grown from cuttings. With apples, scions may be whip-grafted on a piece of seedling root, and the scion planted at least six inches deep in strong, rather moist, but well drained soil. In dry soils and in dry seasons the scions do not strike roots, but under favorable condition the scion throws out a root system the first year. The original piece root may be removed, if it has thrown out roots, when the tree is taken from the nursery. Plums and pears may also be self-rooted by whip-grafting scions on piece roots.

In California the Northern Spy has been successfully self-rooted by inserting the scion by a veneer graft in the side of a whole seedling root a few inches above the crown. The root and scion are planted with the scion at least six inches in the ground. At the end of the season, after the scion has thrown out roots, the trees are lifted and the seedling root removed. The trees are then reset in the nursery, where they are cultivated until large enough for orchard planting.

One of the most successful methods has been followed in Iowa by Col. G. B. Brackett, Pomologist of the Department of Agriculture. It consists in inserting a scion of the desired variety on a piece or whole root. The trees are grown in the nursery for two years, then taken up and laid in trenches. Each branch, after being slightly cut on the upper side, is bent up and well covered with earth, after the usual method of layering. The branches strike the roots during the first season at the cut and bent portion, and in the fall or following spring they are removed from the parent tree and planted in the nursery, where they are cultivated until large enough for the orchard.

To Hasten Fruitfulness.

The insertion of buds in bearing trees hastens the fruitfulness of the variety. As Sourauer says, "by this insertion of a younger portion of a plant on an older stock the former can reap all the advantages of the more advanced age of the latter; it becomes, indeed, older itself." Apples and pears bear in two to five years earlier on scions in bearing trees than they do on nursery-propagated trees of the same varieties, and peaches, plums, and cherries one to three years sooner.

To Perpetuate Desirable Characteristics.

Fruit trees are generally propagated in nurseries from buds taken from vigorous nursery stock. Occasionally the propagator selects the buds from bearing trees, though the stand of nursery

stock is smaller and the trees less vigorous. The nurseryman is primarily concerned in producing a block of vigorous, well-grown trees at the cheapest cost. The fruit grower, in the past, has not concerned himself with the individuality of the stock from which the nursery trees are propagated. His highest ideal is a big, well-grown tree, straight in body, well-branched, and well-rooted. The two ideals have, therefore, been harmonious.

But progressive fruit growers, and some nurserymen, are beginning to pay attention to the character of the parentage of nursery stock. The Baldwins and Elbertas in the same orchards differ in size, productiveness, color, form, keeping quality, and relative immunity from disease. In fact not two trees of a variety are exactly alike, and among the individuals or buds of which the tree top is composed there is also more or less variation. Sometimes the fruit or foliage on a branch is so unlike the rest of the tree that a new variety is introduced by propagating from it. These strongly marked variations are known as "sports," and the Pierce grape, the Banks apple, and the Delaware (Cannon's Early) peach are sport varieties that appeared on branches of the Isabella, Gravenstein and Mountain Rose, respectively.

It has been assumed that the smaller varieties of a variety, such as more productive individual trees, larger or more highly colored fruit, or more vigorous foliage, are likewise transmissible. There is little doubt that permanent variations in a tree no matter how small, may be transmitted by budding or grafting, but a practical difficulty lies in determing whether a variation is inherent or incidental to the food supply or other surroundings of the tree or branch. A well-fed, properly pruned, and carefully tilled and sprayed tree has larger foliage, is more vigorous, and produces better fruit than a neglected tree. But there is no reason to expect transmission of these superior qualities in full degree, unless the descendants are surrounded with an equally favorable environment.

The stability of a variation can be determined only by comparing it for several years wilth other trees growing under similar conditions. If the tree or any of its branches persists in producing fruit or foliage of particular merit, or if the bearing habit is more regular, it is highly desirable to propagate the variety from such trees or branches. There have been no accurate or long-continued experiments in propagating fruits from trees of su-

perior merit. The effort, however, to propagate only from the best is based upon sound principles of plant improvement, and is to be strongly encouraged.

Top working may therefore be used by the fruit grower to perpetuate desirable stable variations. The variety may be budded or grafted on a desirable stock after the trees are established in the orchard. Similar results may be brought about by the nurserymen by propagating only from specially selected buds, but the cost of growing the trees will be greater, and they will need to be sold at a higher price.

Bearing Age of Young Top-Worked Trees.

Scions inserted on old trees bear at an early age, but it is uncertain whether the fruiting of scions grafted on a young tree is accelerated. Young trees, however, top-worked with buds from bearing trees, will bear a year or two earlier than trees propagated with buds from nursery stock, but it is uncertain how much of the influence is due to the top working or to the precocity inherited from the already productive parent. The Sutton orchard in Pl. XXVII, fig. 1, top-worked on Northern Spy stock, at seven years old averaged a barrel and a half of apples to the tree. On the same farm, owned by Mr. George T. Powell, Ghent, N. Y., a Tompkins King orchard top-worked on Northern Spy stock, averaged three barrels per tree in 1902 at 10 years old. Peach trees propagated from buds from bearing trees develop fruit buds the first year while in the nursery.

Details of Top-Working Young Trees.—The Stock.

A single variety selected in accordance with the principles mentioned in the preceding paragraphs is desirable for a stock on which to top work the young orchard. Every consideration of permanency and uniformity discourages the use of miscellaneous seedling stocks. Every seedling is a distinct variety, and no two are alike in hardiness, vigor, immunity from climatic or other difficulties, or in longevity. In severe climates the stock should be established on vigorous, hardy roots; but in other localities the greatest uniformity may be expected from well-grown self-rooted trees, or from trees propagated on specially selected vigorous seedling roots. Where a check to the growth is not especially sought, the stock should at least equal in vigor the variety worked upon it, or the scion will eventually overgrow the stock.

In planting the stock should conform to the usual age for setting the fruit. The tops may be budded with the permanent variety later in the same season if the trees are growing vigorously, or they may be grafted or budded during the second season. It is advisable to top work the orchard as early as possible after it is well established, as the shock to the tree by removing the original top and the loss in energy expended in the growth of the top increases with its age.

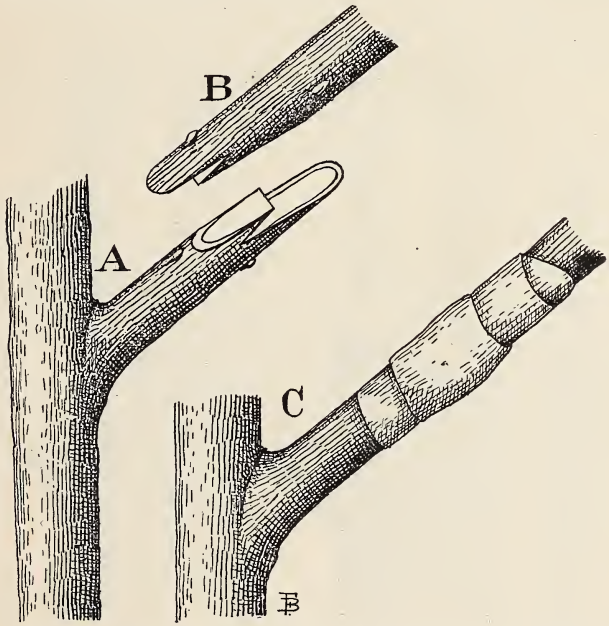


Fig. 15.—Tongue or whip grafting: A, stock prepared: B, scion prepared- C, stock and scion united and wrapped.
"Top-working Orchard Trees, by Fowell, Reprint from Yearbook of Department of Agriculture for 1902."

Grafting.

The young orchard may either be grafted or budded, or grafting and budding may be used in combination on the same tree. The trees may be worked on the body or branches, or on both in combination.

Grafting is the process of inserting a scion on a stock so that the growing parts of both are in contact. The operation is performed in the spring just as the foliage is pushing forth, though it may be done either a little earlier or later.

There are many kinds of grafting, but with young trees in which the branches are not over three-eights of an inch in

diameter, the tongue or whip graft is most common. In making it the scion and stock are cut diagonally, after which a vertical cut is made in the cut surface of each. The tongue of the scion and the cleft in the stock are then joined together and the parts are held firmly with a bandage of waxed string or cloth. The details of the operation are shown in fig. 15. The cleft graft is used for larger branches, and the operations are explained in fig. 16 and in greater detail later on in this paper.

In branch grafting the scions are inserted in three to five

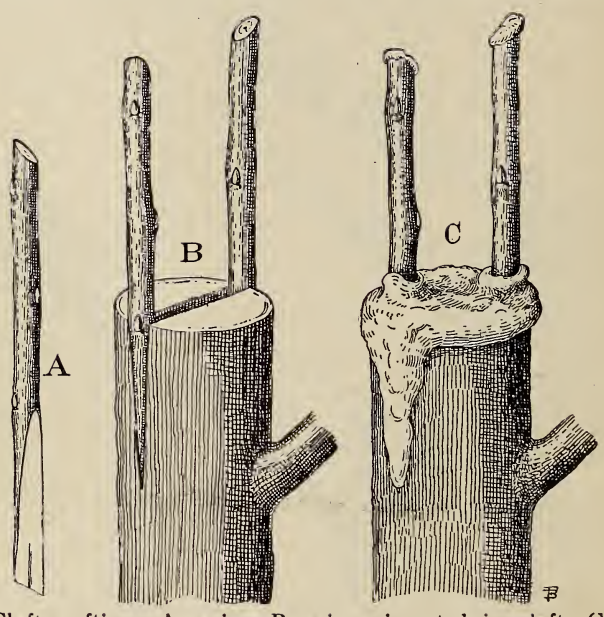


Fig. 16.—Cleft grafting: A, scion; B, scions inserted in cleft; C, stub and scions waxed.

"Top-working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

branches well distributed over the trunk, in accordance with the grower's ideal for a top. A branch-grafted tree, with the scions just pushing forth their leaves, is shown in fig. 17. A similar tree, three months later, is shown in Pl. XXIV, fig. 1. A Sutton apple orchard, seven years old, branch-grafted on Northern Spy, is shown in Pl. XXVII, fig. 1.

The branch-grafted tree develops into a shapely form if the scions live, but the death of one or more of the scions destroys the balance of the top. This may be corrected by inserting a June bud on the same branch or by budding it in the fall, or by regrafting it the following spring. It is a difficult matter, however, to

restore the proportions of a top where the scions are of different ages.

In some sections the larvae of bud moths play havoc with the scions just as they are starting into growth, and make the establishment of a well-formed orchard a most difficult undertaking. The trouble may be largely overcome by inserting the buds in the body of the tree instead of the branches, when any one of the buds alone may become a leader and form a top. (See figs. 18 and 19.)

A single scion is sometimes inserted in the body of the tree, and although it is often successful the method is objectionable, as the stock alone remains if the scion perishes.

Fig 17.—Branch-grafted tree.

Fig 18.— Body-budded tree.

"Top-working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

Budding.

Budding is the insertion of a bud attached to a piece of bark upon the growing part of the stock. There are many kinds of budding, but the shield bud, the details of which are shown in fig. 20, is usually employed with the more common fruits. The operation may be performed whenever the bark will slip, which

occurs just as growth is starting, again in early summer, and in late summer and early fall. In the North budding is usually done from the last of July until the first or middle of September, with mature buds of the season's growth. The buds remain dormant until the next spring. In the South, June budding is also practiced with immature buds, which start into growth the same season. Budding is sometimes done in early spring with dormant buds taken in the winter and retarded in a cool place.

In top working young trees the budding may be done in the branches, on the body, or in both in combination, The branches are selected in the same manner as outlined for grafting, though a bud may be inserted in the body of the tree if no branch is suitably located. Fig. 21 shows a tree with buds in three branches and a bud inserted in the body to balance the top. The buds should be inserted on the branches several inches from the body of the tree, so that the same branch may be rebudded or grafted if the original bud perishes. With spring budding, a second bud may be inserted in June if the first bud dies, and a bud may be inserted in the fall if a June bud dies. A graft may be set or a bud inserted in the spring on a branch in which a fall bud dies. An August branch-budded tree is shown in fig. 22. Three of the buds on the branches lettered B in the illustration failed to grow, and the scions which are just pushing out were inserted in the spring. The bud lettered A was the only one that survived. A branch-budded tree with a top three years old is shown in Pl. XXIV, fig. 2.

One of the most satisfactory methods of budding young trees is to insert the buds in the body. An ideal top can be formed, as the buds can usually be placed in the most desirable positions on the body. A striking advantage also lies in the capacity of any single bud to form a leader and make a top in case of the death of the remaining buds. A body-budded tree is shown in fig. 18, and a similar tree three years later in Pl. XXV. fig. 1. A tree in which two of the buds have been killed with bud-moth larvae is shown in fig. 19, and a similar tree with the top formed from a single bud in Pl. XXV, fig. 2.

Budding is usually more satisfactory than grafting. The operation is more simple, the wound heals more quickly, and the form of the tree can be regulated to better advantage by inserting the buds on the body, but the most satisfactory results follow

the adoption of both branch and body budding on the same tree when one is needed to supplement the other.

Care of Top-worked Young Orchard.

The spring grafted or the spring or fall budded tree should have the remaining branches removed as soon as the scions or buds start into growth. The branch should be cut off an inch or two beyond the bud, and a month or two later, when the danger to the new shoot from blowing out is lessened, it should be cut

Fig. 19—Body-budded tree, with two buds killed by bud-moth larvæ.

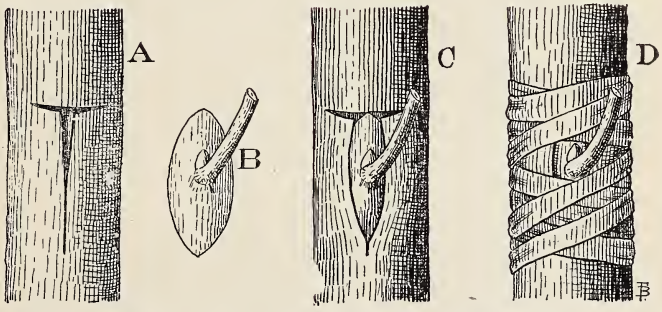


Fig. 20.—Shield budding: A, matrix; B, shield bud; C, bud inserted in matrix; D, bud tied.

"Top-working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

close to the shoot, so that the end of the branch may heal over during the season. It is not always advisable to remove the entire top from a June-budded tree as soon as growth starts, as the buds may grow too vigorously and be blown out. If the water shoots that arise on the body and branches are left until the next spring, the growth of the buds will be retarded.

The top-worked tree needs the most careful attention during the first season. Except in June-budded trees, the water sprouts should be removed three or four times to prevent dwarfing or

smothering the scions. During the latter part of July or early in August the rank-growing branches may be headed in to stock them up, and the side branches need pruning to strengthen them and to give the top a desirable form. After the first year, the tops are treated like any other tree of the same age.

Top Working Bearing Apple Trees.

There are many apple orchards not over 25 to 30 years of age in good healthy condition that might be top-worked with better varieties. It is not profitable to top work the larger trees, as the large branches that need removing do not heal over readily, and the tree usually dies from decay. It is also too expensive to set the scions in the large trees. An apple tree may be remodeled in three or four years by inserting scions in part of the branches each successive season. Branches larger than 2½ inches in diameter should not be grafted, as they do not heal over, and are also more susceptible to sun scald. The operator should endeavor to maintain the original form of the tree. The branches at the top are cut off rather close to the body, and at a greater distance as the base is approached. The large branches need shading while the remodeling is in process. This may be provided by distributing the scions evenly throughout the tree each year and by leaving some of the older branches. Only a few branches should be grafted in one place in a single year, as the exposed stubs, especially in the Southern states, are usually scalded. It is always advisable to graft a larger number of branches than necessary for the final top. The scions shade the branches and may be removed as they overcrowd. A top-worked tree requires close attention if the operation, which is harsh at the best, is to be successful. All large wounds should be painted with red lead to prevent the entrance of fungi and bacteria. The scions should be watched to prevent their dwarfing and somthering by overhanging branches. Water sprouts, which appear in abundance, need removing in June. Every endeavor should be used to re-cover the tree as quickly as possible, and to protect it from injury while the operation is in progress. A tree 25 years of age partly remodeled is shown in Pl. XXVI, fig. 1, and a tree with the entire top replaced with scions in Pl. XXVI, fig. 2.

The grafting is done in the spring with dormant scions, two of which are inserted in a horizontal position in each stub. The stub and the end of each scon are then carefully waxed. The operation may be understood by reference to fig. 16.

Fig. 1.—Stayman Winesap, Branch Whip-grafted on Ben Davis. New Growth 3 Months Old.

Fig. 1.—Missouri Pippin, Branch-Budded on Ben Davis Top 3 Years Old.

"Top Working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

Fig. 1.—Stayman Winesap, Body-budded on Ben Davis. Top 3 Years Old, Formed from Three Buds.

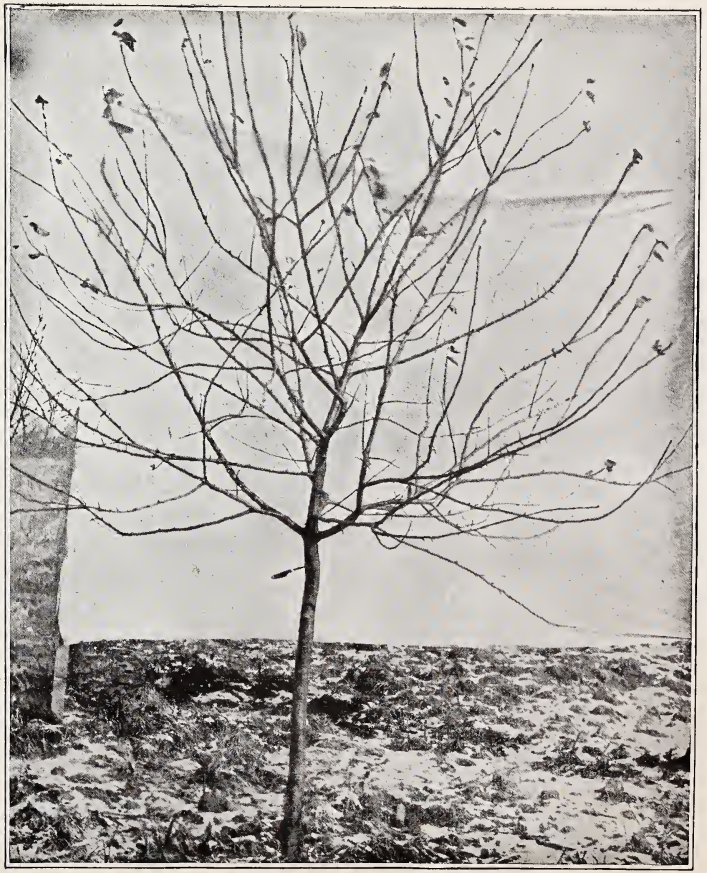


Fig. 2. Stayman Winesap, Body-Budded on Ben Davis. Top 3 Years Old, Formed from One Bud.

"Top Working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

Top-Working Bearing Peach Trees.

There has been a large development in the peach growing business in the last decade. With the rapid growth of the industry many varieties have been planted in large quantities that are undesirable for commercial purposes or ill-adapted to the regions in which they are located. There are also many orchards more than 10 years old, with trees still vigorous, but of varieties that are no longer equal to the newer commercial sorts. To sacrifice the orchards by cutting them out means a loss of labor and cap-

Fig. 21.—Branch-budded and body-budded tree.

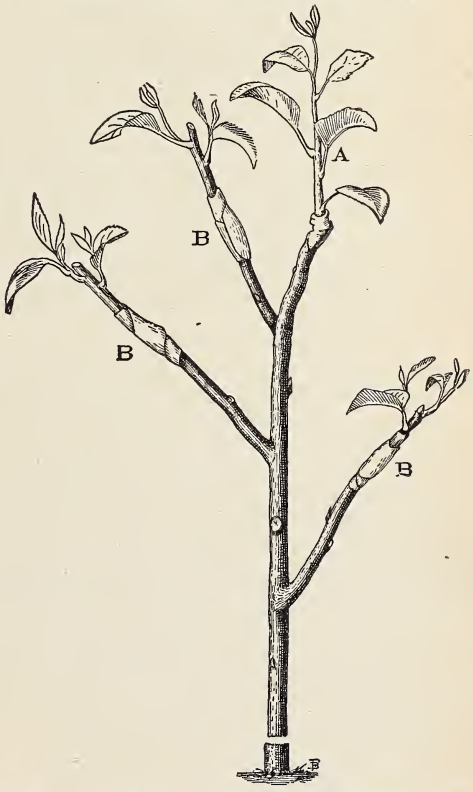


Fig. 22.—Branch-budded and grafted tree. Buds inserted in August. Bud on A lived. Buds on B, B, and B died, and these branches were grafted the following spring.

"Top-working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

ital already invested, but to leave the trees unchanged continues an unproductive investment. It is possible to top-bud these orchards with better varieties, and it may be desirable from the commercial standpoint to do so if the trees have been given good care, as new tops may be formed that will produce good crops in three or four years.

The budding may be done either in June or in the fall, the season depending on the locality and the convenience of the grower. The buds may be inserted on the main branches if the diameter of the latter within six or eight inches of the trunk is not over 1½ inches. On larger trees it is not advisable to bud the main branches, but new shoots in which buds can be inserted may be provided near the trunk of the tree by cutting off the main branches within 1½ to 2 feet of the body, and by thoroughly cultivating the soil after the heads are removed.

In preparing the tree for fall budding it is often possible to pick the fruit, then cut back the top, and insert the buds in three to five of the main branches near the trunk, the distribution of the buds having regard for the form of the future top. In large trees the cutting back is done the preceding winter or spring to provide the new shoots for budding. In the South, however, where the fruit is harvested earlier in the season, it is possible to take the crop, remove the top, and then by frequent cultivation provide new shoots on the larger branches that can be budded in August of the same year.

As soon as the new buds start into growth the old top should be entirely removed and the branches bearing the buds cut back close to the bud. The new shoots that grow on the old branches should be kept off, and the new head formed in accordance with the grower's ideal for a top. It may be advisable to head in the shoots of the new top during the first summer to stock them up and prevent long, slender, weak branches. The ends of the old branches should be painted with red lead to prevent the entrance of fungi and bacteria which cause their decay. If care is exercised in all of the operations, the new top may bear profitable crops for many years.

A tree 10 years of age, with a new top three years old, is shown in Pl. XXVII, fig. 2. This tree should bear a good crop a year later.

Grafting Materials.

There are many kinds of grafting wax, but one made by melting one pound of tallow, two pounds of beeswax, and four pounds of resin is satisfactory for open-air. The melted liquid is poured into cold water, when it hardens. As soon as it is cool it is pulled like molassses candy until it is light colored. The wax may be kept indefinitely by wrapping it in oiled paper and putting it in water.

Fig. 1.—Apple Tree, Top-worked, 2 Years Old. Original Top Partly Removed.

Fig. 2.—Apple Tree, Top-worked, 4 Years Old. Original Top Entirely Removed.

"Top-Working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for 1902."

Fig. 1.—Sutton Apple, Top-worked on Northern Spy.

Fig. 2.—Top-Budded Peach Tree. Stock 9 Years Old; Top 3 Years Old.

"Top-Working Orchard Trees, by Powell, reprint from Yearbook of Department of Agriculture for Year 1902.

In tying whip grafts, waxed string is often used for root work, and for the branches either waxed string or strips of waxed cloth. The waxed string may be made by dropping balls of No. 18 knitting cotton into melted wax. The wax quickly penetrates the ball. The waxed strips may be made by dropping a ball of old cotton cloth cut into narrow strips into melted wax, or the wax may be spread on the cloth, after which it can be cut or torn into strips of the desired sizes.

In budding, raffia is generally used for tying. The raffia can be purchased at about 20 cents a pound. It should be soaked in water for a few hours before using, when it may be cut into strips of the desired length.

Fruits in Plains and Paradise Valleys.

Plains Valley and surrounding country is considered one of the finest fruit districts in the State, and all varieties of fruit that can be grown in Montana will flourish here with more or less success.

It would be folly for me to enumerate the different varieties of apples, plums, pears, etc., that are grown in this section—indeed, space would not permit of such a lengthy article.

There are five or six commercial orchards here, and with two or three exceptions, every farmer and rancher has a home where varieties too numeroous to mention can be fonud..

I don't know but what it is a good plan to follow in the planting of a small orchard, for then one is sure to secure choice varieties for home use that would not pay from a commerical standpoint. However, our commercial orchardists do not grow more than three to five varieties, which is plenty at the very most. Isaac Sears grows the Wealthy and Johnathan for the fall market and the Ben Davis for late winter and early spring. It is needless to describe the Ben Davis for it characteristics are well known, but it is not a good seller in this vicinity on account of its poor flavor, which seems to be its only drawback with us. In point of flavor the Wealthy is the favorite fall apple, but is much given to overbearing and some years falls badly at time of maturity.

The Rome Beauty is successfully grown by A. L. Treat, and, along with the Delaware Red, is considered one of our leading late keepers. Both are much better flavored than the Ben Davis, but the Delaware Red is a small apple unless severely thinned. The Alexander, McIntosh, Spitzenberg and Benton County Beauty have been largely planted, but some are just coming in to bearing and I cannot give my personal observations of them at this writing.

Apples and strawberries are the only fruits grown for shipment at Plains—why, I cannot say. Pears are as easily grown here as apples—indeed, the Bartlett, one of the finest pears the world over, has proven quite hardy in this part of Montana and bears young. The blister mite is the only pest that infests the tree and I believe a commercial orchard of this variety of fruit would be a paying investment for some enterprising man.

Prunes likewise do well here. With me the silver prune is exceedingly hardy and very prolific—bearing successive crops. It is very sweet and has a silver skin, as its name indicates, which is very tough, enabling it to stand long shipment.

I shall not attempt to describe more than one of the many kinds of plums that grow at Plains for all do well—it is a mere matter of choice for home use, and for commercial purposes the variety that combines fine flavor, appearance and good shipping qualities is the one to plant. For beauty, fine flavor, size and hardiness I know of no finer than Peach Plum. Ie bears a striking resemblance to a peach, from whence it derives its name. It ripens in August, is a free stone, delicious to eat from the hand and good for cooking. The tree is an upright grower, bears quite young and is prolific, but is not given to overbearing, which is a great fault with most plum trees.

Sweet cherries, peaches, apricots, nectarines and grapes are grown in this district, but they are so uncertain it would be a losing investment to plant for commerce. Nevertheless, I would advise all fruit growers to plant a few for home use, for when they do bear full crops one feels well repaid for the time and care bestowed on them.

Mr. G. F. Harlan is the only man in Plains who raises successive crops of peaches, apricots and nectarines. His orchard is in an unusually well favored locality. It is situated on the West side, at the base of a large prairie mountain. It is well protected from the morning sun, and the reflections of the afternoon sun against the mountainside keeps the air warm well along into the night, thus insuring good crops of these tender fruits.

There seems to be one serious drawback to the fruit industry, and that is the market. I know it to be a fact that Plains fruit growers experience a great deal of trouble in trying to dispose of their apples. It is not because of their inferiority, but because there is no demand. I understand that on account of high transportation rates the Eastern part of the State will not patronize the fruit industries of Montana. Unless something is done to remedy this evil in the near future the Plains fruit industries will go back instead of progressing, for landowners will not plant commercial orchards when those who already have them cannot dispose of their produce.

Mr. Sears tells me that he considers the Baldwin the finest

winter apple, but that he finds the tree very tender—much given to winter killing. He succeeds with this apple by grafting it on the crab—any variety—and finds it hardy when grown in this manner.

MRS. C. E. BAKER.

Plains, Montana.

FRUIT INDUSTRY IN MONTANA.

During the years 1903 and 1904 there have been planted throughout the State, according to reports received by this office, 865,717 trees and plants. Of this number 524,104 were fruit trees. This would place the total number of fruit trees in the state at 2,174,104. The total acreage of all fruits amounts to 25,000 acres. The total average earnings of this acreage, if all in bearing, would be over six millions of dollars. The value of the total fruit crop for 1904 amounted to about $750,000. The apple crop for 1904 amounted to 350,000 boxes, and at the average retail prices would place the value at about $425,000.

Importations.

Notwithstanding the rapid increase in the production of our own orchards in 1903 and 1904 there was a large amount of fruits imported into the state. During 1903 there was inspected in the state a total of 259,232 packages of fruits. Of this number 191,624 were apples. For 1904 there was inspected 304,981 packages, 130,374 of which were apples. Gradually the amount of apples imported into the States is becoming less. Of course there will always be some importations, as difference in season and lack of sufficient quantity of certain varieties will demand that we import some, and then, too, Montana exports some of her own crop, as certain varieties grown in our State find ready market at good prices in the East. Careful inspection of all imported fruits has raised the quality to number one.

Crab Apples.

For several years past we have been exporting to Eastern states and Canada thousands of boxes of crab apples. So prominent has the Montana crab apple become that buyers are constantly on the watch for our crop. During 1904 there was witnessed lively bidding for choice crab apples and the price reached the highest figure known. Before the close of the shipping season there came a break in the market, caused, no doubt, from the fact that dealers held out too long for still further advances. In the production of crab apples Montana should lead the United States. We can produce in greater abundance good, first class crab apples, and the growers should organize themselves and set the price at a fair figure, not allowing the dealer to speculate to the injury of the industry. The market now enjoyed can be kept and enlarged if fair play and honest methods prevail.

Spread of Fruit Area.

A few years ago the planting of orchards was confined to Missoula, Ravalli and Flathead counties. Outside of these districts little was done even in an experimental way. To-day, however, we find that orchards are being set out in all sections of the State, and some of the newer districts are rapidly becoming close seconds to the older and larger ones. Since the amendment of the law requiring nurseries to secure licenses to do business in the State was passed this office has been brought into close relations with nurseries and from the information thus gleaned we are able to note the rapid growth in planting in the State generally. This spreading of the industry also calls for greater labor on the part of the Board and its employes, and will continue to do so for years. It is pleasing to note this general planting for it speaks for a higher and more prosperous condition for our people.

Home Nurseries.

The past two years has witnessed a healthy growth in nursery business of the State. According to reports received from inspectors there was inspected in the State in 1904, 62 acres of nursery stock, containing about 585,000 trees and 240,000 plants. These nurseries were found to be in good condition, all doing a good business. Each year the acreage in nursery is being increased, more varieties are being propagated, and the sales of home grown nursery stock increasing.

Imported Nursery Stock.

The passage of the new horticultural law in 1903 caused a considerable improvement in the quality of the imported nursery stock which was received for planting. While the Board has carried on a rigid system of nursery stock inspection it has not always been able to examine all the stock received in the state, but being in a position to know when and where the stock would arrvie and from whom it came, it has been able to see a large percentage shipped by the various nurseries and thus has been able to detect any diseased stock that might come in.

Generally the quality of all nursery stock received has been good. It was found necessary to condemn in few instances. A total of about 10,000 trees was condemned during 1904.

Montana Winter Apples.

Each succeeding year finds us producing more and more winter varieties, and each season witnesses the planting of a greater

number of these kinds. Up to within a year or two it was difficult to secure straight carloads of single varieties of winter apples, but the last two years has shown an increase in the number of late keepers and it is possible now for dealers to secure these winter sorts in quantities and store them for winter trade.

Cold Storage.

The question of cold storage for apples has received considerable attention in the past two years. Many of the growers possessing large orchards are deeply interested in the matter and are studying the storage question on the farm and in the city. The results of our experience with Montana apples at the World's Fair will be edited and published in the form of a bulletin at an early date and will contain much valuable data on the keeping qualities of our best varieties. Sufficient experiments have been carried on in this line to determine, however, that Montana apples stand cold storage splendidly, and with good care in the matter of selection and preparing for storage should come out in splendid condition. Cold storage of fruits is a business of itself, and one that requires considerable skill to manage. It is vastly different to the storage of butter, eggs, and meats, requiring closer attention and wider knowledge in general. As yet there are but few plants in Montana that make a business of storing fruits, but no doubt with the demand for storage will come the necessary plants. In reply to a request made of Henningsen Produce Co., of Butte, operating one of the largest and best equipped cold storage plants in the northwest, as to their experience with fruit in storage, the following letter will be of interest to growers:

Mr. Chas. H. Edwards, 103 Clark Block, City:

Dear Sir: In compliance with your request asking for an expression relative to our success with cold storage apples in general, and Montana varieties in particular, beg to advise that while our experiments last season were rather limited, we feel safe in saying that good apples carried in a first class cold storage plant will make their owners' money.

To handle apples successfully it is necessary that the temperature should not vary more than one degree from one end of the season to the other. In our own plant the variation did not amount to that much, we being able to carry our rooms with a variation of not to exceed a fraction of one degree, for a period of six months or longer.

Great care must be exercised in the gathering and packing of

apples for cold storage purposes, as this has a very considerable bearing on the outcome, much more so than where the stock is consumed immediately. We find that where apples are properly handled from the orchard to the storage room, and where desirable varieties are stored, that the shrinkage for a period of six months is nominal; where on the other hand the same apples are handled carelessly, the shrinkage is very heavy. Generally speaking, it pays to wrap apples for cold storage.

We expect to increase our storage facilities this fall, and expect to store a great many more apples than we did a year ago. We are going to experiment with the different varieties, particularly those grown in this state. The writer also expects to store several cars of fancy Wealthy apples, and believes that this variety can be carried much longer than customary, and we expect to have some valuable suggestions to offer next year along this line.

Growers and dealers who are interested in cold storage are always welcome, and we should be pleased to take any one interested over our plant. We believe we have the best and most up to date system in use. Yours very truly,

HENNINGSEN PRODUCE CO.

Per A. P. HENNINGSEN.

Conditions of Orchards.

Generally speaking the orchards of Montana, so far as infestations of any kind is concerned, are in a good, healthy condition. They are well cared for, highly cultivated and systematically pruned. Each year finds their products increasing in value and importance in the trade of the State. The taxable wealth of the State has been increased largely through their planting; they have given employment to a large number of persons and have caused the retention of hundreds of thousands of dollars in the State that otherwise must have been sent to more favored states. In several districts of the State certain localities have been found infected with the coddling moth and every effort possible has been and will be put forth to control and exterminate the infestations.

New Varieties.

Every year finds the growers throughout the State propagating new varieties with the hope that some choice late keeping apples may be found that might make Montana noted for its production.

There are at the present time under consideration a number of varieties, but so far but one of these has passed the experiment stage. The apple that we refer to is the "Akin." The first persons to set out this variety in the State, so far as we can learn, were W. B. Harlan and F. L. Cook, of Como. The trees planted by Mr. Harlan did not live to fruit. Those set out by Mr. Cook grew to be large, healthy trees and fruited when about seven years out. In 1903 Mr. Cook sent a few boxes among his display of this apple for the fair and our attention was then first drawn towards the variety, and we concluded to keep a careful watch over its record in storage. On April 29, 1904, this apple was unpacked and placed on exhibition. It was found to be in perfect condition, and maintained its flavor after coming out of storage longer than any variety on the tables. Later on we discovered that Mr. C. M. Allen, of Allomont fruit farm at Lo Lo, had several hundred of these trees coming into bearing, and we received from Mr. Allen further confirmation of the good qualities of this variety. We are of the opinion, after careful study of this apple, that it is the most prominent winter apple for Montana yet found. The history of this apple as given by Mr. Allen and Mr. Cook, replying to inquiries from this office, will be of interest to growers, as also will that of Mr. E. H. Riehl, in the Rural World:

"The 'Aken apple (Synonims: Akin Red; Akin Seedling, sometimes misspelled Aiken, and Aken, and wholly distinct from 'Akin's Winter,' of Downing, which is a Minnesota crab), is a seedling from the farm of Mr. W. J. Akin, near Lawrenceville, Ills. The seeds were brought from Tennessee and planted in 1831 by Mrs. Mathew England. It was first propagated by Mr. John Akin in 1861; first exhibited before the Illinois Horticultural Society in 1890. Three entries were made: As the best seedling apple, best new apple, and apple best in quality. It was awarded all three first premiums over all competitors, including both old and new varieties. A. C. Hammond, late Secretary Illinois Horticultural Society, said: 'Among all new apples Akin is probably the best. I know it to be an apple of good size, fine appearance, superior quality and a good keeper.' It has also been referred to as near akin to that other apple,

" '———————— the fruit
Of that forbidden tree, whose mortal taste
Brought death into the world, and all our woe.'

"The tree is hardy and an upright grower, resembling the

Northern Spy in habit of growth. The bark is a chestnut brown, tinged with golden. The Yearbook of the Department of Agriculture 1903 gives the following description:

"'Form roundish, slightly ribbed; size medium; surface very smooth and glossy; color yellow, washed over almost the entire surface with bright crimson; dots numerous, variable, but usually small, light russet and frequently indented; cavity medium size and depth and gradual slope, somewhat furrowed, and usually distinctly rusted; stem short to medium, length ⅜ to ⅝ inches, stought, usually downy; basin small, of medium depth and closed; skin moderately thick, tenacious; core large, roundish, open, clasping the eye; seeds of medium size, plump, brown, numerous, 10 to 20; flesh yellowish, moderately fine grained, breaking juicy; flavor rather mild subacid, quality very good. Season, December to April or May; fruit enduring cold storage exceptionally well.'

"I planted 500 of these trees seven years ago and they are just coming into bearing with the Northern Spy, planted at the same time. I regard them as the most handsome apple I have ever seen, and believe they will prove very valuable in this valley.

"Very respectfully yours, C. M. ALLEN."

"It is perfectly hardy, upright growth and does not drop the fruit. I set out the trees in 1894 and they have been bearing three (3) years. The yield last year was good—this year it was light—partly owing to blossoms being destroyed by ants (an insect we are troubled with considerably).

"The apples keep good until in June in an ordinary cellar here. We like the apple and like it better than any other winter apple I've tried. Yours respectfully,

"FRANK L. COOK, Como."

"Some years ago scions of this variety came to us for trial, with the flattering praise that is customary with most new fruit. These were top-grafted on a bearing tree, and the following year a young tree of the same variety was planted near by.

"We were pleased with its vigor, but not with its manner of growth, which was upward like a Lombardy popular. About four years after grafting, when about to condemn the variety, the grafted tree set a full crop of fruit. As this grew heavier it bent the tall, slender branches in all directions. The fruit ripened with Jonathan, which it resembles in size and color, though somewhat different in shape. Its quality is very good. The limbs

remained bent, and have been pretty well loaded with choice fruit every year since.

"The young tree was two years later in starting to bear. Since then, its behavior has been the same as the top grafted tree. We now give the Akin considerable preference to the Jonathan. And we recommend it highly, either for home use or commercial planting. It is a very pretty grower in the nursery.—E. H. Riehl, in Rural World."

The Yearbook of the Department of Agrisulture for 1903 mentions this apple as one of the most promising winter varieties. We believe it is worthy of test by every orchardist in the State, and while it may not suit every locality, we are sure that it could be so generally planted with perfect assurance of success as to make Montana famous in the apple world.

Cherries.

Next to the apple in importance as a profitable fruit in Montana comes the cherry. For years we have been growing all of the sour cherries and some few of the sweet cherries, but it has been only in the past few years that the large sweet cherries, such as the Bing, Lambert, and Royal Ann have been set out in great numbers. The results of these plantings have been highly gratifying, and 1903-1904 saw some of as fine cherries as grown in the world, from Montana orchards, on our markets.

Conclusion.

With each year the study of horticulture is extending in its scope. In the beginning of the work crab apples alone made up the list of fruits studied and experimented with. Next a few of the standard apples of Russian varieties; then the list was tested still further until hundreds of varieties of the standard apples were proven successful. Small fruits of all kinds, of course, formed an interesting study and gave some returns to the experimenter. Gradually has the line of experiment extended until to-day nearly all of the fruits adapted to Northern countries have been tried, and Montana may be justly placed in the list of successful fruit states.

FOURTH BIENNIAL REPORT

OF THE

Montana
State Board of Horticulture

TO THE

Legislative Assembly

OF THE

STATE OF MONTANA

FOR THE YEARS
1905-1906.

"INDEPENDENT PUBLISHING COMPANY, HELENA, MONTANA."

OFFICERS AND MEMBERS OF THE BOARD.

Henry White, First District, Billings.
T. T. Black, Second District, Whitehall.
R. N. Sutherlin, Third District, Great Falls.
C. C. Willis, Fourth District, Plains.
W. J. Tiedt, Fifth District, Darby.
O. C. Estey, Sixth District, Big Fork.
Hon. Jos. K. Toole, Ex-Officio Member, Helena.
Fred Whiteside, Secretary and Inspector at Large, Office Room 33, Hirbour Block, Butte.

LETTER OF TRANSMITTAL.

Office of State Board of Horticulture,
Butte, Mont., January 1, 1907.

To His Excellency,
Joseph K. Toole,
Governor of Montana.

In accordance with law I have the honor to submit the Fourth Biennial Report, Volume IV, of the Montana State Board of Horticulture for the years 1905 and 1906.

FRED WHITESIDE,
Secretary and Inspector at Large.

PREFACE.

In this report routine matters and statistics of doubtful interest have, so far as possible, been omitted, and the endeavor made to confine the report to matters of value to those interested—both directly and indirectly—in fruit growing.

Besides a review of the work done by the State Board of Horticulture and statistics showing the volume and character of business done in Montana in the fruit industry, other information, formulas and tables deemed to be of value to fruit growers, have been included in this report, the purpose being to help in a practical way those engaged in the business.

For handy reference the Montana Horticultural Law, together with the Rules and Regulations of the State Board of Horticulture, are printed in the report.

REPORT OF THE MONTANA STATE BOARD OF HORTICULTURE.

To His Excellency,
Joseph K. Toole,
Governor of Montana.

To the Governor and Legislative Assembly of the State of Montana:

In compliance with the provisions of the law, I have the honor to submit for your inspection the following report of the work of the State Board of Horticulture and its officers and appointees for the years 1905 and 1906:

REVIEW.

The present secretary was elected to the position by the Board on March 20, 1905, since which time he has practically had charge of the work carried on by the Board. At the same meeting in March, 1905, Mr. T. T. Black of Whitehall became a member of the Board by appointment, to succeed Mr. E. N. Brandegee, retiring member. And at the same meeting the offices of Secretary and Inspector at Large were consolidated. On May 1, 1906, Mr. J. O. Read, President, resigned as a member of the Board, and Mr. W. J. Tiedt of Darby, Montana, was appointed by Governor Jos. K. Toole to fill the vacancy.

When the present Secretary took up the work for the Board in March, 1905, the office had been vacant for some time and much complaint was being made about the prevalence of diseased fruit in the Montana markets, apples infested with Codling Moth being particularly abundant, all such fruit having been shipped into the state from outside points. By close inspection and by requiring a strict compliance with the law by shippers, the Montana markets were in a short time cleared of infested fruit, and since that time such fruit has reached our markets only in a few isolated instances. While a rigid enforcement of the law has engendered some friction it has been less than might have been expected.

The amount of fruit and nursery stock condemned has been comparatively small, and on the whole dealers have benefitted by

the law, for it has compelled consignors to send here a better grade of goods than was formerly shipped into this market, and both the dealer and consumer have benefitted.

As local inspectors receive as compensation only the fees collected on goods inspected, it has been difficult to keep good men as inspectors at points where the volume of business is small, and under such circumstances it is difficult to keep the markets entirely free from infested fruit or nursery stock.

Duding 1905 and 1906 the funds at the disposal of the Board have been used in fighting orchard pests in the fruit growing counties, principally the Codling Moth, in Missoula and Flathead counties. This is by far the worst pest known to the apple industry, its ravages having almost wiped out the business in some states. Fortunately it has not yet secured a wide foothold in Montana, and a few thousands spent at this time will save millions of dollars in the future. The work of fighting the Codling Moth in Montana has been confined to the fruit growing sections, for, while the Moth is known to exist at Helena and a few other points, the danger of its spreading from such points is very slight, as it could only leave such points through shipments of local fruit, and no such shipments are made.

The Codling Moth has been known to exist in Missoula for a long time, and in 1904 it had spread to a number of orchards outside of the city limits, while practically every tree in the city was badly infested. While the Moth appeared more recently at Kalispell, in 1904 every tree in the city was infested, and it had spread to orchards about one mile beyond the city limits. As the infested orchards in the Kalispell district belonged to over three hundred owners, and those in he Missoula district belonged to over six hundred owners and the orchards were of all kinds and conditions the work of fighting the Moth was most difficult. Early in the spring of 1905 a complete record was made of both the Kalispell and Missoula districts, giving in detail the location, name of owner, number and kind of trees, and the condition of the orchard. As the work of inspecting and banding of trees was carried on, the work done each day was marked upon the record of each particular orchard, and in this way the exact condition of the work was known at all times, and the possibility of missing infested trees was avoided. The record was also used for the purpose of mailing notices of instruction, and asking the

co-operation of owners of orchards. The result of the work done has been most gratifying. In the Kalispell district the people co-operated in the work most willingly and the moth has been practically exterminated in this district, the larvae of the moth having been found in only one place in Kalispell in 1906.

In the Missoula district the work has been much more difficult, and the results have been less satisfactory, although good progress has been made. The people of Missoula generally have been less willing to co-operate in the work, and in a few instances refused to allow the work to be done until legal steps were taken by representatives of the Board, and in one instance after an orchard had been sprayed the owner was found washing off the trees with a garden hose.

The trees being older and larger in Missoula, and in places surrounded by board walks, outbuildings and shrubbery, has also made the work more difficult.

The apple, pear and crab- apple are the only fruits molested by the moth. The eggs laid on the young fruit by the moth hatch into worms in a few days, and these at once bury themselves in the fruit where they grow to maturity. The poison can only be sprayed on the outside of the fruit, and unless the worm is poisoned when it first begins to eat, it escapes the poison entirely, for this reason it is the most difficult pest of all to overcome, and not more than 80 per cent of the worms usually can be killed by spraying. The others must be caught in the bands, or be killed by destroying the wormy fruit, and it is in this part of the work that the co-operation of the people is effective. It is safe to say, if each one of the six hundred owners of fruit trees in the Missoula district would examine his own trees once a day for a week after the worms hatch, and pick and destroy all wormy fruit, the Moth could be exterminated in a single season.

The spraying is of little value unless it is followed by other work to kill the worms which escape the poison. Various preparations of Paris Green and Arsenate of Lead have been tried for spraying, and the best results were obtained from the use of "Disparene," an arsenate of lead preparation made by the Bowker Insecticide Company of Boston. The advantage in this preparation is chiefly in its qualities of adhesion, as after it is once dry it is not easily washed off by the rain.

The first spraying is done soon after the blossoms have fallen,

in order to get the poison well into the blossom end of the fruit where the worm usually enters. The second spray is put on about the time the eggs are hatching, usually from June 12th to 20th, and to catch the second brood the spraying begins about August 1st, but the dates of spraying vary somewhat with the seasons. Clean cultivation of the orchard has been found to be a great help in exterminating the moth. After the worm has grown to maturity it leaves the fruit, and hides in a convenient place near the tree, where it spins a cocoon, from which it later hatches into a Codling Moth. If clean cultivation is practiced the worms are forced to seek shelter under the bands of burlap placed on the tree, or they are devoured by the birds and other enemies provided by nature.

Two power spraying machines were purchased by the Board in March, 1906, and these have proved to be a good investment. The spray pump is operated by a gasoline engine, and besides doing the work much better it is much cheaper and quicker than the hand spray.

In the Missoula district the moth has been exterminated in all orchards outside of the city, and has been greatly reduced in the city, but owing to the fact that most of the trees in the city are in close proximity to walks, fences, shrubbery and other ideal shelters for the larvae of the moth, it will require radical measures to eradicate the moth from the city, and I believe such measures should be taken at once. To accomplish this end it will be necessary to pick and destroy the fruit in every yard and orchard where clean cultivation is not practiced, and this should be done after the eggs of the moth have been laid and before any of the worms come to maturity.

Under the present law the owner is supposed to treat all infested trees when notified by the inspector, but in many instances the owners are non-residents, and in other instances the owners are so dilatory in doing the work or it is done in such a poor manner that it is worthless. In such cases the inspector has power to do the work, and the owner becomes liable for the cost, but in most cases the cost of collection is greater than the amount collected, as the only available method is a suit at law against each individual owner. I would suggest that the law be amended so that the cost of such work becomes a tax upon the property, to be collected with other taxes by county officials.

I would also suggest, that the law be amended giving the Inspector at Large power to quarantine an orchard, and allow the fruit to be used upon the premises. Under the law, as it now stands, the inspector must condemn and destroy all infested fruit, and a notice of quarantine would often be quite effective in isolated orchards.

Besides the Codling Moth several other insect pests have appeared in Montana, but none of them threaten to become serious. The worst of these is perhaps the Oystershell Bark Louse, which has appeared at several places in the state. The Red Spider, Wooly Aphis, Crown Gall and a few other pests have appeared in isolated instances; descriptions and remedies for all of which will be found in the chapter on Fruit Pests and Remedies.

Under the law and the rules of the Board local inspectors have been given as compensation for services all fees collected up to $5.00 per day. Prior to 1906 all excess fees received from local inspectors, and all fees received for nursery licenses were expended by the Secretary in the regular work of the Board. The vouchers and accounts being checked up by the State Examiner. In 1905, however, the Attorney General advised this office that such disbursements were illegal, since which time all such fees have been remitted to the State Treasurer. As these remittances have been placed in the general fund, and not to the credit of the fund against which the State Board of Horticulture may draw, the funds available for the use of the Board have been reduced to this extent, amounting to about $1,000 per anuum, and this has hampered the work to a considerable extent during the past year. I would advise that the annual appropriation be increased to cover this matter or that such fees remitted to the State Treasurer be credited to the fund, against which the State Board of Horticulture may draw.

RECEIPTS AND DISBURSEMENTS "APPROPRIATION FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1905.

RECEIPTS.

Appropriation, 1905	$3,500 00

DISBURSEMENTS.

General Expenses—		
Printing, engraving, publishing, office and spraying supplies	$477 55	
Rent and telephone	281 85	
Expenses Board members	130 65	
Services and expenses Inspector at Large.	793 25	
Local inspectors' services and expenses	1,602 56	
Balance unexpended and available for 1906	214 14	
	$3,500 00	$3,500 00

RECEIPTS AND DISBURSEMENTS "APPROPRIATION FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1906.

RECEIPTS.

Nov. 30, 1905—Unexpended balance, available for 1906.	$ 214 14
Dec. 1, 1905—Appropriation 1906	3,500 00

DISBURSEMENTS.

General Expenses:		
Printing, office supplies and advertising	241 60	
Two machine sprayers, freight and spraying supplies	887 87	
Labor and inspection orchard work	889 45	
Rent, telephone and postage	490 25	
Expenses Board members	71 10	
Telegrams, express, freight and transfer	30 80	
Services and expenses nspector at large	705 00	
Publishing of proceedings of State Horticultural Society 1906	150 00	
Balance, unexpended reverting to general fund	248 07	
	$3,714 14	$3,714 14

RECEIPTS AND DISBURSEMENTS "FEE FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1905.

RECEIPTS.

Balance on hand Nov. 30, 1904	$ 268 28
Fruit fees	4,450 55
Licenses	300 00
Nursery stock and fumigation	52 25
Rent	48 00

DISBURSEMENTS.

Fees to inspectors	$4,076 81	
Rent, general work and supples	655 19	
Traveling expenses secretary	117 70	
Postage, telephone and telegraph	60 29	
Freight, express and transfer	10 15	
Remittances to state treasurer	198 94	
	$5,119 08	$5,119 08

Unfinished Business for the Fiscal Year Ending Nov. 30, 1905, Subsequently Reported.

Nursery stock and fumigation		$42 00
Fees to inspector	$42 00	
	$42 00	$42 00

RECEIPTS AND DISBURSEMENTS "FEE FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1906.

RECEIPTS.

Fruit fees	$4,773 63
Nursery stock and fumigation	351 90
Licenses	625 00
Inspector's excess of fees remitted	157 27

DISBURSEMENTS.

Fees to inspectors	$5,125 53	
Remittances to State Treasurer	782 27	
	$5,907 80	$5,907 80

FRUITS INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1905.

	Packages.
Apples	155,843
Pears	14,064

Peaches	54,744
Plums and prunes	37,975
Cherries	11,992
Apricots	3,552
Quinces	127
Oranges and Tangerines	42,985
Lemons and Grape Fruit	13,911
Grapes	65,558
Strawberries	15,540
Blackberries	3,678
Raspberries	9,978
Dewberries	323
Blueberries	71
Currants	598
Gooseberries	626
*Total	431,565

*Of this amount there was inspected in Butte 320 cars, or 263,734 packages, which includes all express and local freight shipments

FRUITS INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1906.

	Packages.
Apples	175,657
Pears	15,055
Peaches	79,992
Plums and Prunes	55,647
Cherries	12,603
Apricots	1,203
Quinces	55
Oranges and Tangarines	52,929
Lemons and Grape Fruit	14,562
Grapes	62,973
Strawberries	14,678
Blackberries	4,418
Raspberries	11,961
Dewberries	444
Blueberries	25
Currants	867
Gooseberries	751
*Total	503,820

*Of this amount there was inspected in Butte 337 cars, or 251,252 packages, which includes all express and local freight shipments.

FRUIT CONDEMNED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1905.

	Boxes.
Apples, Pears and Apricots (for codling moth and San Jose Scale	884
Peaches (for Gummosis and Twig Borer)	936
Total	1,820

FRUIT CONDEMNED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1906.

	Boxes.
Apples (for Codling Moth, San Jose Scale and Oystershell Scale)	791
Pears (for Codling Moth, San Jose Scale and Fire Blight)	131
Peaches (for Gummosis and Twig Borer)	222
Apricots, Plums and Prunes (for San Jose Scale)	30
Total	1,174

In addition to the above one car apples and two cars peaches were sent out of the State as unfit for market.

FRUIT TREES, PLANTS, ETC., SHIPPED INTO MONTANA AND INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1905.

Apple trees	23,805	
Crab apples	1,463	
Pears	723	
Peaches	506	
Plums and Prunes	3,049	
Cherries	3,173	
Apricots	14	
Quinces	32	
		32,765
Shade Trees	315	
Ornamentals, Shrubs and Bulbs	1,483	
		1,798
Black and Dewberries	2,122	
Raspberries	4,100	
Mulberry	28	
Currants	870	
Gooseberries	648	

Grapes	644	
Strawberries	18,655	
Buffalo Juneberry	23	
Rhubarb and Asparagus	79	
		27,169
Total		61,732

FRUIT TREES, PLANTS, ETC., SHIPPED INTO MONTANA AND INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1906.

Apple trees	46,713	
Crab Apples	4,749	
Pears	2,601	
Peaches	270	
Plums	2,097	
Cherries	4,482	
Apricots	23	
Quinces	19	
		60,954
Shade trees	11,089	
Ornamental Trees, Shrubs and Bulbs	6,845	
		17,934
Evergreens	735	
Roses	964	
		1,699
Black and Dewberries	1,270	
Raspberries	4,504	
Mulberries	2	
Currants	1,947	
Gooseberries	2,086	
Grapes	1,562	
Strawberries	2,287	
Buffalo Juneberry	23	
		13,681
Total		94,268

NURSERIES INSPECTED FOR THE YEARS ENDING NOVEMBER 30, 1905 AND 1906.

Number of Acres	150
Number of Small Plants	95,000
Number of Trees	820,000
Number of Trees Condemned and Destroyed	3,640
Disease condemned for	Root and Crown Gall

NURSERY STOCK CONDEMNED AND DESTROYED IN THE STATE FOR THE YEARS ENDING NOVEMBER 30, 1905 AND 1906.

Apple, (Crown Gall and Root Knot)	4,745
Apple, (Wooly Aphis)	777
Apple (Oyster Shell Bark Louse)	15
Apricot (Crown Gall)	1
Plum (Crown Gall)	23
Total	5,561

In the year 1905, there were 131 notices of shipments of nursery stock received; 12 licenses issued to nurserymen; 53 salesman's certificates supplied; 61 inspector's reports received; 987 letters were written; 1,000 circulars were mailed out; 1,000 copies of the Third Biennial Report of the Board distributed; 500 copies of the horticultural laws and rules were transmitted; 1,000 notices to fruit-growers were mailed and posted; notices were also published in various newspapers of general circulation in the State.

During the year 1906, 173 notices of shipments of nursery stock were received; 25 nurseryman's licenses were issued; 181 inspector's reports received: 1,043 letters were written; 1,500 circular letters were mailed out; 2,000 copies of the horticultural laws and rules were transmitted; notices were also published in various newspapers generally circulated in the state.

FRUIT GROWING IN GENERAL.

The following pages are intended not so much for the experienced fruitgrower as for the beginner.

Much of the information contained is of an elementary nature, and is designed to help and encourage those who are new in the business, and perhaps induce others to embark in a calling which is at once interesting, honorable and profitable.

Fruit-growing may with truth be said to be in its infancy in Montana, for, while the amount of fruit now produced is considerable it is as nothing when compared to the possibilities of the State in this direction.

The reasons for the comparatively slow development of the industry are not hard to find, while every portion of the State

is adapted to the production of fruit of one kind or another, the various sections vary so much in soil, altitude, climate and other conditions, that the varieties and kinds of fruits that may be grown successfully vary greatly in the different sections. To ascertain the varieties of fruit adapted to any particular locality long years of experimental work are necessary. While the varieties and kinds of frut grown in the entire country are almost infinite, the varieties that can be successfully grown in any one locality are very few, and it is not strange that in most instances the first trees planted have not been adapted to the particular locality where planted and most of the pioneer fruit-growers have paid dear for experience gained in planting unprofitable varieties, or after learning the best varieties to plant, and ordering these from the nurseryman, when the trees came into bearing after years of careful attention they were found to be not true to name, and to be varieties totally unsuited to the locality In view of these facts it is not strange that many of the first orchards planted in Montana have been unprofitable, and that the industry has been slow in its development. In spite of all this, however, a few men have persevered in the effort, and great has been their reward. Where suitable vareties of apples or crabs have been planted the crop of a single season has in instances brought more than $500.00 per acre to the grower, and cherries have in some cases brought even greater returns. Small fruits have also proved to be very profitable to the careful grower, and to the man of moderate means these are the best crops to grow because of the quick returns.

As before stated many of the first orchards planted, and even some of the more recent settings have proved to be of poor varieties, and while some of the owners of such orchards became discouraged, and neglected them, others have been changing the poor varieties into good ones by top-grafting, with most excellent results.

While the fruit-growers of all sections have many adverse forces with which they must contend, those who follow the business in this State have advantages that are enjoyed in few other localities The climate here is such that most of the insect pests do not thrive well, and are consequently kept down with a minimum of labor While the shortness of our season restricts us to the production of certain varieties the intensity of our grow-

ing season, with the crisp mountain air and fertile soil, combine to give our fruits better flavor than those grown farther south or in lower altitudes. Besides these natural advantages, we have the further advantage of an almost unlimited home market, by reason of the mining, lumbering and stock-growing industries of the State, and all things considered, the outlook is most encouraging for the Montana fruit-grower, and the industry is bound to become one of the most important in the State.

THE APPLE.

The apple is justly called the "King of Fruits," and most horticultural writers, at least, have forgiven Mother Eve for falling a victim to its charms. While we are restricted in the number of arieties that may be successfully grown in Montana, we are more than compensated for this by the superior quality and freedom from blemishes of the apples grown here. While many Montana apples of poor quality are to be seen in the market, it is because varieties not adapted to the locality were planted, and no one is to blame for this, because the best varieties to plant could only be learned by years of experience, and the grower is not to be blamed for trying to make the best of a mistake that was unavoidable. The marketing of this class of apples undoubtedly injures the market for better fruit, but as the commercial orchards are gradually being converted into better varieties this class of apples will disappear.

VARIETIES.

The question which concerns every apple grower most is, "What varieties shall I plant?" This question must be answered differently in almost every locality. For often a difference of only a few miles in location makes a wonderful difference in the varieties that can be successfully grown. There are, however, a few varieties that can be successfully grown in almost every section of Montana, and these will be first considered, although most of them, strictly speaking, are not perfect commercial apples; but perhaps it will be as well to admit at the beginning that the perfect commercial apple has not yet been discovered. Most of the apples that can be grown successfully over a wide area of the state belong to the early or fall varieties, and the fact that they are not long keepers makes them unprofitable to the large commercial grower, but for the small grower, conveniently

located with respect to market, they are usually very profitable. In this class are the Red June, Yellow Transparent, Duchess of Oldenburg and Red Astrachan. Of these four, the last named is perhaps the least desirable, while the Red June is one of the best. It is fine in quality, and being a dark red all over does not spot or discolor from bruising. It is not quite as large as the other varieties named, and like the Yellow Transparent, needs severe thinning. A most serious objection to the Yellow Transparent is its tendency to spot under the slightest bruise, and this objection also holds in less degree against the Duchess, and in fact against all yellow apples. Other early apples grown successfully in places, but not yet widely distributed, are the Gravenstein and Benoni. While the foregoing are called early apples, the date of ripening varies greatly with locality and altitude. Other apples grown successfully in almost every portion of the state are the Snow, Alexander, Wealthy, McMahon White and McIntosh Red. These ripen very close together in point of time, and in some places the last four are called Fall apples, in other sections they are Late Fall or Early Winter apples. As a rule apples ripen later and keep longer east of the Rocky Mountains than do the same varieties west of the Mountains, and in this respect the Flathead Valley is somewhat later than points south on the same side of the range.

The Alexander is one of the best fall apples grown in Montana. It is very large, of fine appearance, color red and yellow, and of fair quality. The Snow is of about the same season as the Alexander, much smaller, but of very fine quality, red in color with some green. The Wealthy is perhaps the most widely distributed apple in the northwest, and in many respects is one of the best. In localities where it ripens late it may be classed as a good commercial apple, but where it ripens early it is not as good, because it does not keep as well. Where it ripens early it is inclined to fall from the tree, and begins to wither in two or three weeks after picking, even in the best of cellars. Its color is red, with some green, quality fair, size good. The McMahon White is of about the same season, size and keeping qualities as the Wealthy, whiteish green in color, more acid than the Wealthy and is fine for cooking. All things considered, the McIntosh Red is perhaps the best commercial apple widely grown in Montana. While in a few sections the tree has not been con-

sidered entirely hardy, yet losses from winter injury have not occurred in the coldest sections where the trees are grown, and such losses have probably been due to local conditions. The apple is of the finest quality, and has a spicy flavor peculiar to itself. It is of good size, dark red in color, and keeps until about January first, although like other apples, its keeping qualities varies with the date of ripening in different sections. The tree is of good shape and a very vigorous grower.

Of the varieties mentioned the Yellow Transparent and Wealthy are the most prolific bearers, with the Red June a close second. The others are good bearers but cannot be depended upon to produce a full crop every year. The reason for light crops, however, is usually to be found in a lack of cultivation, pruning, thinning or other necessary work.

It can be said without fear of successful contradiction that no long keeping Winter variety of apple with all the necessary qualifications of a commercial apple, and suited to all localities has yet been introduced in Montana. At any rate, if there is such an apple it has not yet been tested in all sections of the State. Several varieties of apples of this description are being grown successfully in one section or another, but it remains to be seen how widely any of these can be grown, and some of them we know have not been successful in all localities; among these may be mentioned the Northern Spy, Jonathan, Wagner, King and Spitzenburg.

The Bethel is an apple of fine quality which gives promise of being a valuable variety, but it has not yet been widely tested. The Missoula is a new variety or an old variety under new conditions and name, which is also very promising. The two last mentioned are both red in color, of good size and in keeping qualities are somewhat better than the McIntosh Red, which is usually called an Early Winter apple

Other varieties that are successfully grown in one locality or another are the following: Yellow Newtown, Pippin, Rhode Island Greening, Rome Beauty, Antonovka, Okobena, Longfield, Tollman Sweet, Canada Red and Wolf River.

Most nurseries have one or two high priced novelties in apples, and these are widely advertised as the best on earth and are put out at fancy figures, but they are worthless in most localities. In planting a commercial orchard it is best to stick to the

best varieties that have been tested in the vicinity, planting a few only of new varieties as an experiment.

It is also best to buy from the nursery nearest the land to be planted. Trees from the home nursery are more apt to be true to name; they are acclimated and are injured less in moving than the trees that are shipped long distances.

PEARS.

One of the most profitable fruits to the Montana grower is the pear, and while this fruit cannot be grown successfully in all sections of the state, yet in those localities suited to it, it grows to greater perfection than in any other state west of the Rocky mountains. In Montana pears do well in almost every locality, but east of the main range only a few hardy varieties seem to withstand the climate, and these, as a rule, must be planted in favored places. Many varieties of pears will not mature in this climate; but where the right varieties are planted in the right locality the result is a most delicious and luscious fruit.

The pear is especially well adapted to the needs of the small grower by reason of the quick and steady returns which it gives, for most varieties are early and regular bearers. The small grower can also handle the fruit to much better advantage than the commercial grower, for the reason that it is comparatively short lived, and must have the best of care in order to reach the market in good condition; but when properly handled the returns are much better than from some other varieties of fruits.

The varieties most widely grown in Montana are: The Flemish Beauty, Clapp's Favorite and Bartlett. As to which of these varieties is the best depends on locality. The Sheldon and Sieckel are also grown quite successfully in places.

CRAB APPLES.

When grown on a commercial scale, one of the most profitable fruits in Montana is the crab apple. When produced in less than car lots, however, the grower must depend on local demand, which is usually unsatisfactory.

Crabs can be grown successfully in every section of Montana, and the risk from winter losses is very slight.

For market the best variety is undoubtedly the Transcendent, and for this varety in car lots the demand is almost without limit, the price usually being from $1.00 to $1.10 per box, f. o. b.

Montana points. Other varieties grown are the Hyslop, Martha, Gibbs Golden, North Star, General Grant and Whitney No. 20, the last named being as large as the ordinary small apple, and is delicious for eating out of hand, but is very short lived. None of the crabs, however, are long keepers.

PLUMS.

Plums are grown successfully all over Montana, but some varieties can only be grown in favored places.

From the standpoint of profit, plums are perhaps the most unsatisfactory of all the fruits grown in the state. This is not due to any lack of quality or productiveness, but to the poor methods of packing, inadequate transportation facilities, and the perishable nature of the fruit.

The Bradshaw, Moore's Arctic and De Soto are among the hardiest varieties grown. The Wyant and Forest Garden are reported from the Experiment Station at Bozeman as being very hardy.

Other varieties successfully grown in more favored places are: The Lombard, Yellow Egg, Green Gage, Peach Plum, Tragedy, Pond's Seedling, Italian Prunes, and German Prunes.

CHERRIES.

All things considered cherries are among the most profitable and satisfactory fruits grown in Montana. While the trees are not as hardy nor as long lived as the apple or crab, the hardy varieties can be grown in most sections, and west of the main range the cherry is a standard crop. The demand for the fruit is almost unlimited, and the price received by the grower is from eight to ten cents per pound.

Sweet cherries are produced very successfully in certain sections of the Bitter Root and Flathead, but cannot be grown in all sections, as the trees are not entirely hardy, and even where the trees grow, do not always fruit well, but where the sweet cherry can be grown, it is highly profitable. Of the sweet cherries, the Bing and the Royal Ann are the varieties most widely grown. The Bing is perhaps the favorite, being a large, dark red cherry of fine quality. The Royal Ann is equally large, but lighter in color. The Lambert is also grown successfully in places.

The sour varieties of cherries are much more widey grown than the sweet cherries, and are prolific and regular bearers.

Of these, the Early Richmond, Vladimir and Ostheime, are perhaps the most hardy, with the Montmorency, English Morello and Wrag close up in point of hardiness. Of all the sour cherries the Montmorency is probably the favorite, being a little larger than the Early Richmond and not as sour as the others.

The Wrag, English Morello and Ostheime are dark red in color and are splendid for making wine.

PEACHES.

Montana is popularly supposed to be too far north to permit the growing of peaches, but near the shores of Flathead Lake, and also in a few places in the Bitter Root, peaches of fine size and quality are grown. Peaches are also being grown on quite a large scale in Carbon county, but the trees are covered in winter.

The varieties which have proved most successful are the Triumph and Champion, the first named being the earliest.

SMALL FRUITS.

Practically all varieties of small fruits do well in every section of Montana, and the production of these fruits is a most inviting field for the efforts of the husbandman. East of the main range, strawberries are usually covered with a winter mulch of straw or hay, and cane fruits are generally laid down and covered with earth in the fall; but on the western slope, where the snowfall is greater and the climate less rigorous, these measures are seldom resorted to

The small fruits grown in Montana are unexcelled in quality; the yield is abundant, and, as the home demand is always greater than the supply, the prices received by growers are usually good. Such fruits also bring quicker returns to the grower than the orchard fruits, and all these things combine to make the business most attractive to the small grower, but the business is most exacting in every detail. In fact, every feature of the work, from preparing the soil for the plants to the marketing of the fruit, is an exact science, and only those who follow it in the most thorough manner can hope to succeed.

FRUIT LANDS.

The lands best adapted to fruit growing are the rolling foothills and bench lands. If not too close to the high mountains,

such lands are freer from frost than the low lands of the valleys, and they afford good drainage, which is required by nearly all fruits.

BEST AGE TO PLANT.

In orchard planting most growers of experience prefer trees not more than two years old from the nursery, and many orchardists plant yearling trees with very satisfactory results. The future growth of a tree is retarded by transplanting in proportion to its age and if trees from one to four years old are planted at the same time, in the same soil, and are given the same care, in a few years the younger trees will be larger than the older ones. For this reason young trees are preferred for plantng.

PRUNING.

When the tree is planted, the top is generally cut back to make it balance the root, as the roots are cut severely in digging the tree. The best practice, however, is to reduce the top by cutting out the superfluous limbs. This will give the tree proper shape, and will force the growth into the limbs that are to form the permanent top of the tree. There is much difference of opinion as to the proper shape for a tree, and particularly the apple tree. The growers of most experience, however, have no fixed rule for shaping or pruning the tree, each tree being treated according to its requirements. If a tree is a very upright grower, the inside branches are cut out to make the tree more spreading. If the tree is very wide and spreading, the outside branches are cut off to make the tree more upright. The ideal form which most growers endeavor to reach, is an urn-shaped tree, with the trunk dividing into three or four main branches about two or two and one-half feet from the ground, these three or four branches forming the entire top of the tree. The main branches should start out at nearly right angles to the trunk, and curve upward, which will obviate the danger of the tree splitting down. This danger is further provided against by twining together two of the small inside branches from opposite sides of the tree. These will grow together, and form a solid tie across the tree, and if the tree has four main branches there should be two of these ties fastening the opposite main branches together. A tree that is properly shaped when planted will require no pruning, except to keep the suckers and small limbs trimmed out, and

this should be done at least once a year. Winter or early spring is the best season to prune, as the trees are then bare of foliage, but most growers avoid pruning when the wood is frozen. If a tree is planted with a large number of branches, these must be cut out from year to year, and much of the energy exerted in growing wood, is thus wasted.

IRRIGATION.

Most of the fruit produced in Montana is grown under irrigation, and the study of irrigation, as applied to fruit growing, is something that should be taken up in a systematic and scientific manner by the horticulturists of the state.

Too much water is injurious to fruit of any kind, and there can be no doubt that many fruit growers would be more successful if they practiced more cultivation and less irrigation. This is well illustrated in Flathead county, where practically all fruit is grown without irrigation; clean cultivation being practiced, and fruit of that section keeps longer and reaches the market in better condition than fruit of the same varieties grown under irrigation.

FERTILIZING.

The complaint is often heard that old trees produce small fruit, but this is no doubt due to the fact that the same crop is taken from the soil year after year without any adequate return having been made to the land. If the soil is properly fertilized and tilled, old trees will produce fruit of the same size and quality as the younger trees. If barnyard manure is not available for fertilizing, a crop of peas or clover sown between the rows and plowed under when in blossom will greatly enrich the soil. Some orchardists grow clover in the orchard, but this should only be practiced where plenty of water is available for irrigation, and the crop of clover should be left to rot on the land.

MULCHING.

If a mulch is used around the trees it should be of well rotted manure, or other material that will not form a harbor in which the mice can nest, as they are almost certain to eat the bark from the trees during the winter. In some sections entire orchards have been killed in this manner.

THINNING.

One of the problems that has claimed the attention of fruit growers for many years has been the disposition of second class apples; but this problem has recently been solved by growers of the Pacific Slope by thinning the fruit until there are no second class apples produced; practically all of the apples produced being first class, and this really is the only correct solution of the problem. By severe thinning and rigid rules for packing, these wesern growers have brought the price of Spitzenberg and Newton Pippin apples from about $1.00 per box up to $2.60 per box, the entire crop being sold by the carload through the Fruit Growers' Union. The same thing can be done in Montana, but the work must start at the bottom. First, the worthless varieties of apples must be changed by top-grafting into desirable sorts suited to the locality where grown; and then by proper cultivation, pruning, irrigation, thinning and packing the Montana grower can get the highest price paid in the world for apples, for when the proper varieties are grown under proper conditions the Montana apples are excelled by none.

Apples should be thinned to one in a place, and these not closer than five inches apart on the limb. To accomplish this, it is often necessary to remove four-fifths of the crop; but measured in pounds the matured crop will be fully as large as if no thinning had been done, and instead of small second class apples the product will be large, first class apples. Thinning should be done as soon as possible after the apples are formed. Fruit growers often complain about the excessive labor and cost of thinning but it requires no more time or labor to take the extra fruit off in the spring than to pick the small apples in the fall.

APPLE BOXES.

Montana growers have long endeavored to secure a box for apples that will suit all growers, and frequent changes have been made in the size of the standard box. This effort to adopt a box that will prove satisfactory to everybody is futile; because apples of different size and shape cannot be packed to advantage in the same sized box, and the man who grows Alexander apples does not want the same shaped box as the man who grows Jonathan or Spitzenberg. It would seem more rea-

sonable to fix the standard cubic content of the box and allow certain variations in shape to suit the apples to be packed. This would result in a long, narrow box for small varieties, and a wide. short box for the large ones.

COLD STORAGE.

While our season is too short in most sections to permit us to compete in the production of many of the long keeping apples, yet the use of cold storage will enable us to put our apples on the market when both demand and prices are good.

Cold storage is destined to play an important part in the future apple industry of Montana.

DISTANCE TO PLANT.

In many of the first orchards planted in Montana, the trees were set entirely too close together. Apples should not be planted closer than twenty-four feet apart each way, and plums, pears, and other sorts, not closer than twenty feet each way.

PICKING AND PACKING.

In handling and packing fruit the Montana grower has much to learn, and he might study the methods of his western neighbors to good advantage. As a rule, it is only necessary to look once at a car of fruit coming into Butte or Helena to know whether it is from Montana or farther west, and the difference in the pack is even less marked than the difference in price, the foreign apples invariably bringing the better price.

In picking apples the best growers pick directly into boxes, handling each apple as if it were an egg. The boxes are put in the cellar or cold storage until the apples are to be sold, when they are packed in tiers in new boxes, and put out at once.

VARIETIES.

There are many varieties of apples and fruits grown in Montana that are not mentioned in this report, and many of those mentioned are only suited to certain localities. The bane of most fruit growers is a plethora of varieties. Many of them having twenty or thirty varieties, only three or four of which are really suited to the locality. For this reason, the varieties mentioned in the report are restricted, in the hope, that beginners will confine hemselves to varieties that have been tried; planting only a few of other varieties for the purpose of testing them.

TOP GRAFTING.

Where an orchard contains varieties unsuited to the locality—and there are many such in Montana—the only remedy is to change the varieties by top grafting. To change a large orchard in this manner appears to be a difficult task, but it is not as difficult as it appears. The best season for top grafting is just after the first strong flow of sap has started in the spring, which is usually in May, and top grafting can usually be done successfully during this entire month. The scions are cut during the winter, only the growth of the last season being taken, and these are packed in damp sawdust or sand in a cool cellar until used. In cutting the tree to be grafted, about two-thirds of the top is cut away. The tree is cut thus severely in order to force the growth into the grafts. It is best to cut the limbs as near the trunk as possible without cutting limbs that are too large. Avoid cutting limbs that are more than one and one-half inches in diameter, if possible.

Both the split graft and the bark graft have been used extensively in Montana, and in an orchard in Flathead county where 3,000 trees were top worked in 1906, both methods were tested quite thoroughly, and where the work was well done the bark graft gave much the best results.

In this work the wax was put on hot, with a small brush. The wax was melted and put in a five pound lard pail, which was suspended inside of a ten pound lard pail, in the bottom of which had been placed a small alcohol lamp, the heat from the lamp keeping the wax at the proper temperature. The wax was composed of five parts rosin and one part tallow, by weight, no beeswax or other ingredient being used. This wax is very cheap, and will not melt or run under the hottest sun. The trees were cut two or three weeks ahead of the grafting. The scions were put in by a man, the wax being put on by a boy, and the bark grafts were wrapped with a strip of waxed cloth, about half an inch wide, to hold the scion in place and prevent warping of the bark. This work was also done by a boy. The total cost of grafting eight and ten year old trees was eight cents per tree. The remainder of old tops will be cut out next spring, and where needed additional grafts will be put in. This will cost about five cents per tree additional. Where possible, it is best to leave about a six inch stub in cutting limbs, in order that a second graft may

be put in if the first one dies. This is done the following season, first cutting off the old stub.

INSECT ENEMIES AND DISEASES.

For much of the information herein contained on this subject the writer is indebted to Prof. R. A. Cooley of Bozeman, and Professors C. D. Ball and R. S. Northrup of the Utah Experiment Station.

If it were not for injurious insects and plant diseases, the growing of fruit of any kind would be comparatively easy. These insidious foes meet the grower of most sections at every turn, and tax his ingenuity and skill to the utmost to overcome them. Successful fruit growing is getting to mean more and more, a constant battle with insects and fungi. At first view this seems discouraging, but after all it is the one factor that assures the wide awake, industrious fruit grower a fair price for his goods, for the sloven cannot control these pests and must ultimately be forced out of business.

The Montana fruit grower has an advantage over the growers of most sections in that the climatic conditions of this state are not favorable to the spread of most of the insect pests, and they can be controlled with a very small amount of labor as compared to other sections. California has met with considerable success in fighting insect pests by introducing parasite insects to prey on the pests. Most of these parasites are varieties that work on the enemies of the citrus fruits, but parasites for the Codling Moth and Oyster Shell Bark Louse are now being tried, and if these prove successful an effort will be made to introduce them into Montana.

HOW BEST TO CONTROL AND ERADICATE THESE PESTS.

Insects are of two distinct classes. Some are the biting (mandibulate), others are of the sucking (haustellate) kind, each group involving a special system of treatment.

For the biting insects, such as the Codling Moth, Tent Caterpillar, Cut Worms, etc., a spray that deposits a poison upon the fruit or plant on which the insect feeds is used, such as Paris Green or any of the Arsenate of Lead solutions. Of these the most effective is Disparene, an Arsenate of lead preparation made by the Bowker Insecticide Company of Boston.

For the insects, such as the Aphis, Red Spider, Oyster Shell Bark Louse, etc., which live by sucking the juices of the plant or fruit, a spray must be used that will kill the insect when it comes in contact with the body, such as Kerosene Emulsion, Lime and Sulphur, Tobacco Decoction or Whale Oil Soap and Quassia Chips.

Fungus diseases come from the growth of parasite plants which use the fruit, trees or fruit plants as host plants. Bordeaux Mixture is the universal remedy for these diseases. Copper Carbonate Solution is also used to some extent, and Lime and Sulphur is effective in some cases.

THE CODLING MOTH OR APPLE WORM.

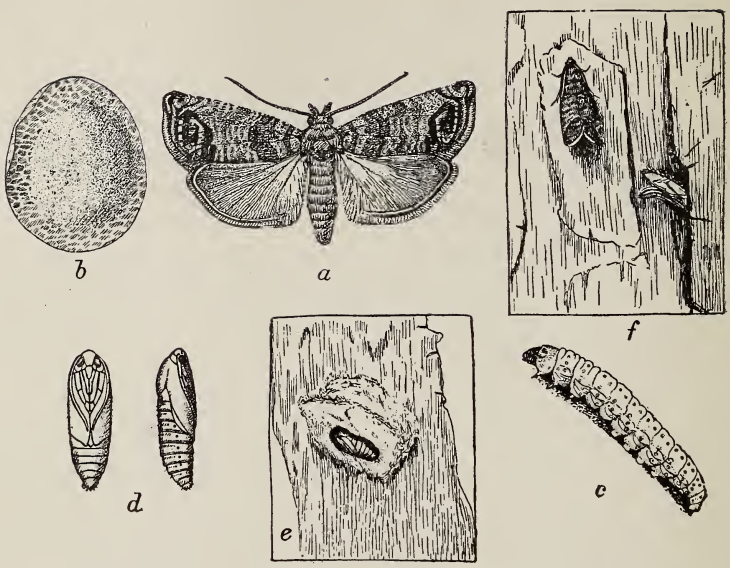
The well known apple worm is enormously destructive to apples and pears in the United States. It is said to destroy, on an average, about one-half of the apple crop of the United States annually. Its injuriousness is much less in Montana than in some other states where the climatic conditions are more favorable to it, but we believe that the percentage of damage under ordinary conditions will vary from about 15 to about 55, when nothing is done to hold it in check. The apple is Montana's most successful fruit and the Codling Moth its worst insect enemy.

The Codling Moth is two-brooded in Montana. The first eggs of the season are laid about the middle of June. By the latter part of July wormy apples become noticeable. The second brood begins its operations about the 10th to the 15th of August, and is principally injurious to fall and winter varieties.

It occurs in a few isolated localities in the following counties: Flathead, Sanders, Missoula, Ravalli, Broadwater, Yellowstone, Lewis and Clark and Custer.

For means of wide distribution the Codling Moth is mainly dependent on traffic in fruits. It has extended itself throughout practically the whole world, and is believed to have done so almost entirely through the medium of fruit packages. It is a particularly dangerous practice to carry second hand fruit boxes into the orchard to be filled again. This practice is now prohibited by law.

This insect does more damage than all others with which the apple grower has to contend. The worms pass the winter in tough cocoons hidden beneath the rough bark of the trunk or



THE CODDLING MOTH: a, the moth or adult insect, slightly enlarged; b, the egg, greatly enlarged; c, the full-grown larva, slightly enlarged; d, the pupa, slightly enlarged; e, the pupa in its cocoon on the inner surface of a piece of bark, reduced about one-half; f, the moth on bark and empty pupa skin from which it emerged, about natural size. (Simpson U. S. Dept. Agr.)

larger limbs, in cracks or knotholes, or under rubbish in the orchard. The moth is nearly the color of the apple bark and flies with a zigzag motion. It never flies to light and is rarely seen. The moths hatch out a week or two after the blossoms fall and lay their eggs on the upper surface of the leaves, close to an apple, or on the apple itself where the fuzz has been rubbed off. The second brood of eggs is nearly all laid on the apples. The great majority of the little worms of the first brood go in at the calyx, while of the second brood, about half, go in at the side of the apples. The worms remain in the apples about twenty days and then crawl down the tree and hide in the bark. It takes about fifty days for one complete generation, and there are but two broods in a season in this state. The worms of the second generation remain in the cocoons over winter.

Remedies: Spray with Disparene, Paris Green or Lime Arsenic as soon after the blossoms fall as possible. Repeat in ten or fourteen days. If the orchard has been badly infested or is within a quarter of a mile of other infested ones from which moth may fly in, spray three times for the second brood.

Never spray the tree when in blossom on account of bees and honey.

The first two sprays should be thrown from above down and from the sides in, so as to force the poison into the calyx cups. For these sprays use a coarse, fan-shaped spray that will carry six feet before it forms a mist. The two sprays should be continued until every flower has been thoroughly soaked and the trees are dripping heavily. For the later sprays use a finer, mist-like spray and stop as soon as the trees begin to drip.

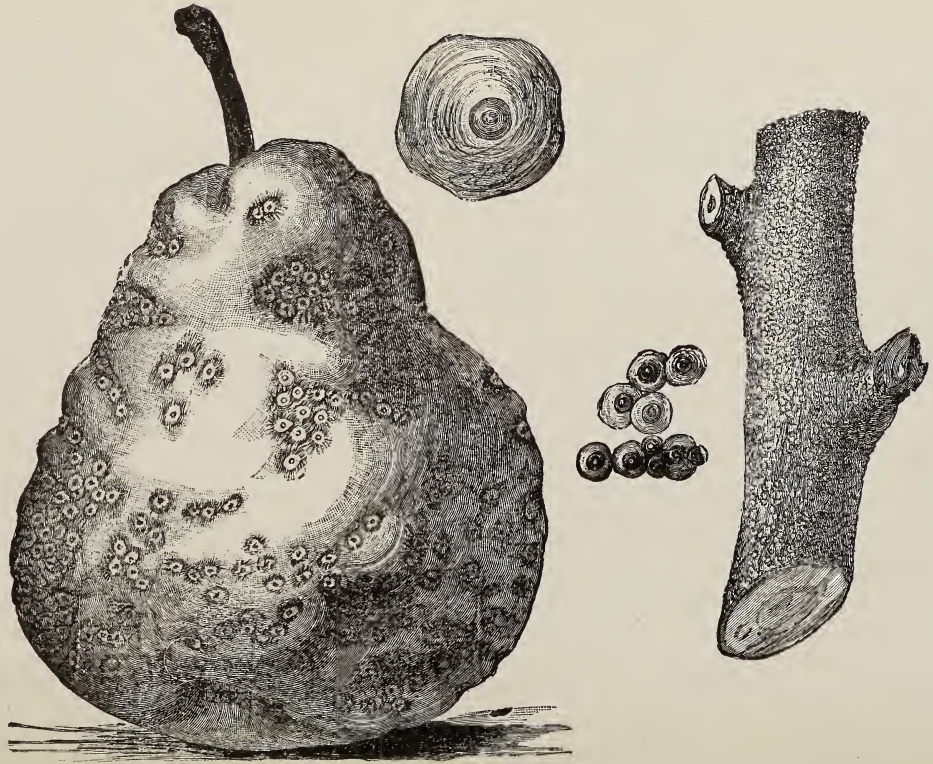
Put bands on the trees a month after blossoms, and remove every ten days and destroy all larvae until the 20th of August, then leave on until picking time. Scraping the bark in the spring, screening the fruit house, and picking off all wormy apples about two weeks after the first worms come under bands, will also aid in keeping them down. Clean culture is also a great help in fighting the Moth. Pruning the trees and thinnng the fruit also make the work easy.

For further information on this subject see page 3— of this report.

SAN JOSE SCALE.

This is the most pernicious of all the scale family. It is a sap sucker and cannot be poisoned, but must be killed by contact. It attaches itself to the bark of the tree, giving it a dirty, scurfy appearance. In its worst stage it encrusts the twigs and branches, the tiny sales often overlapping each other. The insect punctures the bark, poisoning and discoloring the tender cambium or under bark, as though it had been punctured with fine needles dipped in analine dye.

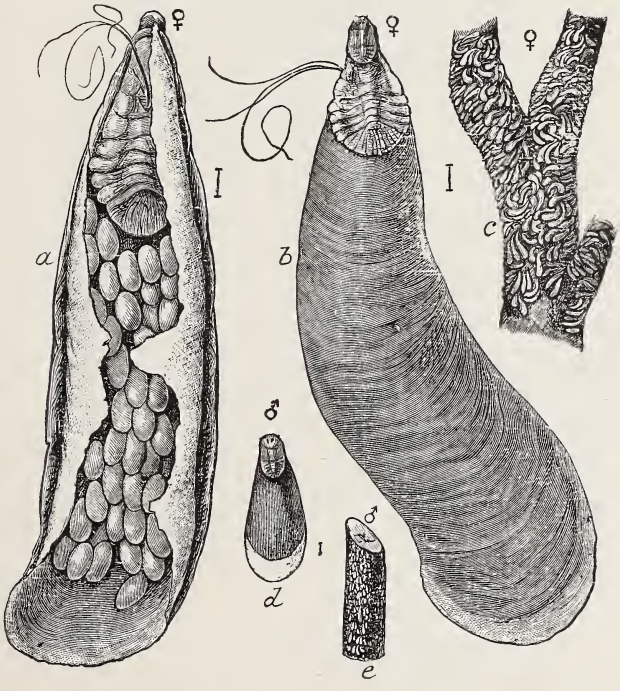
Remedies: In the summer time, while the young are hatching and before they become attached and have developed their impenetrable shell or scale, they may be combatted successfully with Kerosene Emulsion applied in double strength. The most thorough, practical and effective remedy for all scale insects is the Lime-Sulphur solution. If this solution is properly made and applied as directed, its caustic properties will kill all scale and other insects which it may come in contact with; also the eggs of the Red Spider and every species of aphides. The hydrocyanic acid gas is also a very effective remedy for the San Jose Scale.



SAN JOSE SCALE. A Pear infested by San Jose Scale. Portion of a branch infested by San Jose Scale. Female San Jose Scale—enlarged. Young developing San Jose Scale. (Division of Entomology, U. S. Dept. Agr.)

THE OYSTER SHELL BARK LOUSE.

The insect is so named because of the resemblance which the scale bears to a long, rather narrow oyster, and this renders it easily recognizable. It came to this state evidently on nursery stock, and is found at Plains, Selish, Lo Lo, and at Missoula. Under the work of the Board, with the co-operation of the growers, it is being reduced considerably; it is hoped will in due



The oyster-shell bark-louse. a, showing female scale and eggs from below; b, female scale seen from above; c, female scales, natural size; d, male scale; e, male scales, natural size. (L. O. Howard, Division of Entomology, U. S. Dep. Agr.)

time be eradicated. It is detrimental to profitable and successful apple growing.

The cast skins of the larvae are at the narrow end of the scale and form its head. The females come to maturity during the latter part of August, fertilization having taken place in the earlier portion of the same month, and egg-laying continues into September, when the entire space below the scale will be found filled with minute, pale yellow eggs; something over one hundred in some cases, though often much less. These eggs re-

main during the winter, protected by the scales, and from them hatch the crawling larvae in June. Growth is slow; there is only one brood, and when not excessively abundant the insect does not do much injury. As a matter of fact, however, it does often become excessively abundant, and lilacs or apple trees may become so covered that no portion of the bark can be seen between the scales.

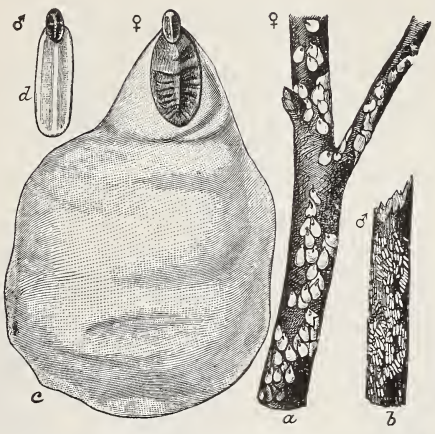
Among fruit trees it is found on the apple, pear, plum, quince, currant raspberry and wild cherry, though apples are the most susceptible and branches are occasionally destroyed. It also establishes itself on the fruit. Young trees may be killed in some instances, and old trees are much harmed. Walnut and butternut trees are very susceptible to the attacks of this species, and are sometimes killed even when of considerable size. Of the shade trees, willow, maple and poplar are sometimes injured. It is also found on the rose.

Remedies: The most effective insecticide yet employed against the Oyster-Shell Bark Louse during the dormant period of the tree is the Lime-Sulphur, or Lime-Sulphur Salt wash. An application of this wash during the latter part of March or first weeks in April, followed in the case of badly infested trees by a second application before the buds have swollen much, will generally suffice to eradicate the scales. The Kerosene Emulsion spray, or any contact poison spray, is also effective if applied just after the young have hatched in June.

THE SCURFY SCALE.

With the San Jose, Oyster-Shell Bark Louse and the Scurfy Scale fruit pests, we have three common orchard scales. We will now briefly consider the Scurfy Scale.

This "Scurfy Scale," or "Harris Louse,' is much broader than the oyster-shell louse, much paler, almost white in color, and much thinner in texture. The cast larvae skins are at the narrow end of the scale, and in general the life history is like that of the preceding species. The larvae also hatch during the early days of June, and are orange rather than yellow in color. The male scales are comparatively very small and almsot snow white. The eggs are developed in September and are deep purplish brown, varying from twenty to eighty or more, but fewer in number than the oyster-shell bark-louse.



THE SCURFY BARK-LOUSE. a, females; b, males; natural size; c, female; d, male. (L. O. Howard, Division of Entomology, U. S. Dep. Agr.)

This scale prefers the pear among orchard trees, and the Keiffer is its favorite variety. Of the shade trees, poplars are most frequently infested, and of the small fruits currants are usual victims. Pear trees are sometimes so badly infested that their trunks seem whitewashed, and in such cases serious injury or death results.

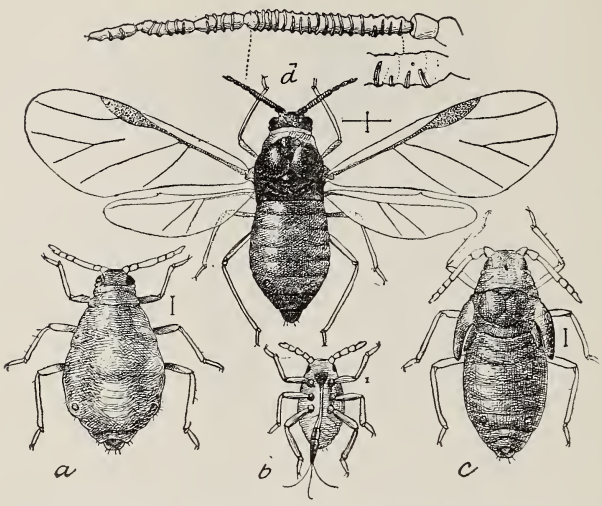
There is only one brood of these scales, and the winter is passed in the egg stage.

Remedy: Lime and Sulphur spray applied as for oyster-shell bark-louse scale.

WOOLY APHIS.

Appears on the trunk and branches of the apple tree as white, wooly patches which show a red color when crushed. Later in the season they migrate to the smaller limbs and twigs. Another form occurs below the ground where they form knot-like swellings along the roots.

Remedies: Spraying with Lime-Sulphur Mixture in winter or Kerosene Emulsion in summer, will hold them in check. Pure kerosene or a strong emulsion driven with force against the patches in early summer will tend to keep them down. For the root infesting form, scraping away the dirt and scattering several pounds of tobacco stems to the tree has been recommended.



WOOLY APHIS. a, agamic female; b, larval louse; c, pupa; d, winged female with entenna enlarged above; all greatly enlarged with waxy excretion removed (original) [Division of Entomology, U. S. Dept. Agr.]

APPLE APHIS.

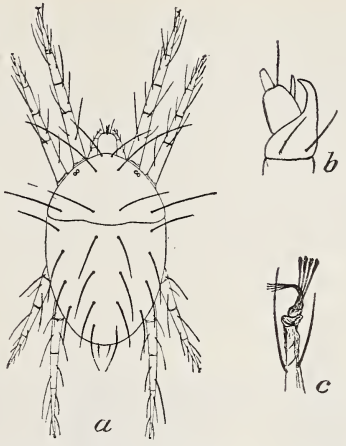
The shiny black eggs of this pest may be found during the winter on the terminal twigs and strong growing shoots. They are usually placed around the buds and in the crotches. The lice hatch about the time the leaves start and soon curl them up, and if numerous stunt the growth of the tree.

Remedies: Winter spray with the Lime-Sulphur Mixture will destroy the eggs. When only a few trees are affected, a strong Kerosene Emulsion may be used, or the eggs may be crushed by the hand. Just after the eggs hatch an ordinary Kerosene Emulsion will kill the young. Later they curl the leaves so that a spray will not reach them. Spray also with Tobacco or Whale Oil Soap and Quassia Chips.

RED SPIDER OR BROWN MITE.

Minute reddish or greenish mites working on leaves and stems of fruit and shade trees, and sucking their juices so that they turn yellow and die. They can usually be detected by the sickly, yellowish color of the plant along with a slight webbing or the presence of reddish mites. The Brown Mite lays bright red eggs in the fall, usually in clusters on the main trunk or branches, and when numerous, easily seen at a distance.

Remedies: The Lime-Sulphur Spray in the spring just be-



RED SPIDER. a, Adult, enlarged; b, Palpus; c, Claws.
[Div. of Entomology, U. S. Dept. Agr.]

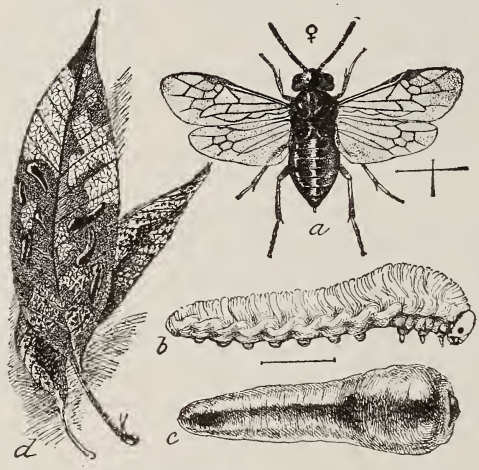
fore the buds start is the easiest means of destroying the eggs. In summer, spray with a strong Kerosene Emulsion or Whale Oil Soap, one pound to five or six gallons of hot water.

THE PEAR LEAF BLISTER MITE.

The presence of this pest is readily known by the bright red pimple-like spots that appear on the young leaves. Later these spots turn green and then brownish, forming cork-like thickenings on the under sides of the leaves. The cause of the spot is a minute four-legged mite, scarcely visible to the naked eye, and measuring but one-hundred-and-fiftieth of an inch long. Its body is cylindrical in form and marked crosswise by numerous striae. As soon as the leaves burst from the buds in spring the mites burrow into them, forming the bright red galls, which are hollow and have minute openings on the under sides of the leaves. In these galls eggs are laid, which soon hatch into young mites. As fast as new leaves come out the mites migrate to them, forming new galls, and this process continues as long as leaves are developed. Before the leaves fall in autumn the mites crawl back to the twigs, and pass the winter in cracks in the bark and similar places, but more particularly beneath the scales of the winter buds. At no stage of the mite's life is it able to move fast, but the pest becomes spread from tree to tree by crawling on insects, the feet of birds, and probably in similar ways. The damage done is sometimes quite severe, as the func-

tion of the leaves is seriously impaired by their attacks The affected leaves also fall prematurely.

Remedies: Experiments with this pest have not been very satisfactory. Spraying in winter when the mites are under the bud scales with Kerosene Emulsion (diluted only three times), gave the best results, but this strength also injured the trees somewhat. In no instance were all the mites destroyed. Protracted periods of cold weather are fatal to the pest.



PEAR AND CHERRY SLUG.: a, adult saw fly, female; b, larva with slime removed; c, same in normal state; d, leaves with larvae natural size; a, b, c, much enlarged (original). (Div. Entomology U. S. Dep't. Agr.)

PEAR AND CHERRY SLUG.

A dark, slimy green larvae with a big head which feeds on the leaves, turning them brown in spots. There are two broods in a year, one appearing in June or early in July, the other in August. The second brood usually does the most damage, and where numerous enough will strip an entire tree and kill it. The larvae grow to be about a half inch long and they go into the ground and pupate, coming out a black fly-like insect.

Remedies: Spray with Paris Green or Lime Arsenic as soon as damage is noticed. When fruit is nearly ripe, the trees may be dusted with White Hellebore or dry air slaked lime instead.

CHERRY AND PLUM APHIS.

A deep brown, almost black, plant-louse, infesting cherry and plum trees of all ages to such an extent as to prove very an-

noying at times. Leaves, young twigs, blossoms, and even fruit, may become blackened with multitudes of these lice. Sometimes they are abundant during the early part of summer and then suddenly disappear, and are not again seen until the following spring. The infested leaves curl up in the manner common to injury by puncturing insects, and growth may cease completely. Adult lice measure about .06 inch in length, are rather broad, the abdomen almost rotund and shining. It occurs on other trees of the genus Prunus.

The eggs are laid in the fall about the buds, as is the case with the apple leaf aphis.

Remedy: Spray with Kerosene Emulsion, diluted so as to avoid burning the foliage, or with Tobacco Decoction, or with Whale Oil Soap and Quassia Chips.

CABBAGE APHIS.

The lice often gather in immense numbers on the under side of the leaves later in the season. Use same remedies as for other lice, except that he spray nozzle must be set at an angle, so as to rest unler the plant anl spray up against the lice.

CABBAGE WORMS.

Green worms that eat the leaves and finally spoil the head of the cabbage.

Remedies: Spray early in season before the head is formed, with Paris Green or Disparene. This may be continued up to within two weeks of picking time with safety, provided no heads that have holes in them are used.

STRAWBERRY LEAF ROLLER.

A small rusty-brown moth with white marks. Appears in the patch in the early summer and a little later a greenish worm is found rolling the leaves and destroying them. Another brood comes on later in the season.

Remedies: Spray soon after the moths have become abundant in the partch, with Paris Green or Lime Arsenic, and again about the time the berries form. Mow the vines as soon as the crop is off and sprinkle with straw and burn as soon as dry.

STRAWBERRY CROWN BORER.

Its head is yellowish brown; the jaws dark at the tips; the rest of he body is white; length is one-fourth of an inch; its

body measures about one twelfth inch in diameter. It much resembles a very small grub worm, but unlike all grub worms it lacks jointed legs, not having any use for them, as it does not travel from plant to plant. Usually but one grub is found in each plant.

The small white grub works in the interior of the underground stem, where it is concealed from observation, and kills or enfeebles the plants. Cutting open lengthwise an infested plant, a broad mine is discovered filled with refuse extending from the bases of the petioles of the leaves down towards the lower end of the stem, and the whole interior of the stem may be eaten away. The grubs change to pupae and these in turn change to beetles, which leave the plants late in the fall and burv in the ground.

Treatment: No method has been devised which will destroy the grubs without also injuring the plants. The best method is to dig up all the infested plants and destroy them.

STRAWBERRY WEEVIL.

Is a small black beetle, attacking the buds and blossoms of the strawberry, destroying the stamens of the bi-sexual varieties and ruining them both for fruit and for purposes of pollination.

Remedy: Kerosene Emulsion or White Hellebore, the plants to be sprayed as soon as the buds are set.

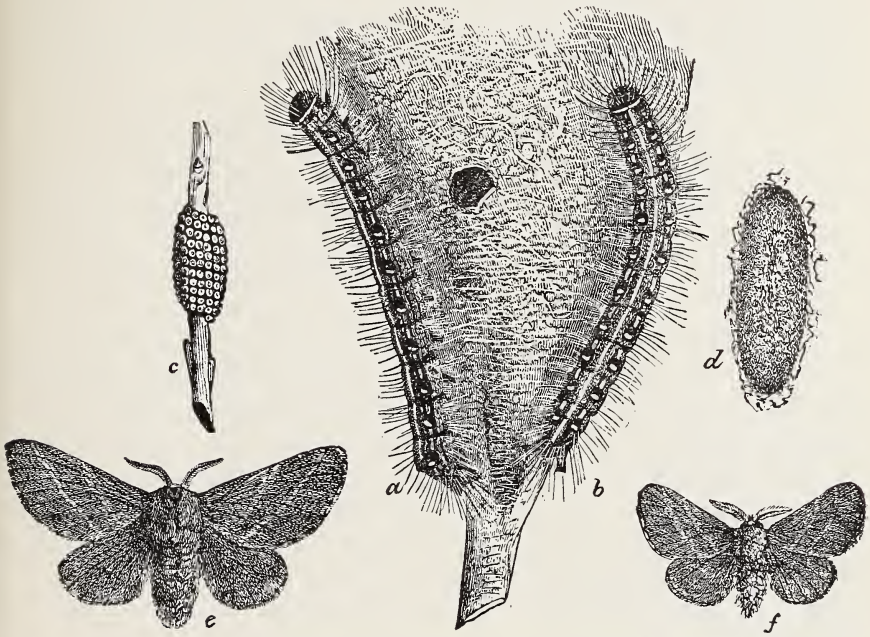
THE TARNISHED PLANT-BUG.

This bug attacks fruit trees, also bush fruits, such as grape, raspberry, blackberry, currant, gooseberry and strawberry. The latter suffering the most, as the bug punctures the berries and extracs the sap from the young, developing berries and fruit, thus causing them to button, shrivel and die.

The adult insect is a little over one-fourth of an inch long and is grayish brown with yellow markings. A few streaks of red occur on the thorax.

Remedy: No satisfactory remedy has thus far been devised. Spraying is not very effective, as food is taken up through a sucking beak, and the poison thus secured being harmless. Contact poisons are unavailing, due to the heavy covering with which the insect is supplied by nature. It is a persistent and troublesome pest, and on low growing plants is almost impossible to control, but on trees their number can be reduced

at least by jarring the tree during the cold portion of the day, and catching them in a receptacle running toward the center, where a can or pail is set conaining some kerosene and water.



APPLE TREE TENT CATERPILLAR: a, b, tree tent—caterpillars; c, eggs; d, cocoon; e, female moth; f, male moth.

TENT CATERPILLAR.

This insect has stripped the fruit and shade trees in a number of towns in the state. It is easy to control. The eggs may be found in creamy or waxy rings around the smaller twigs during the winter time. These hatch with the appearance of the first leaves, and the colony of little caterpillars spin a web and eat the leaves, migrating from branch to branch, and when larger, resting in masses on the trunk without a web. When full grown they come down and spin a cocoon and soon come out a yellow brown moth.

Remedies: Spray with Paris Green or Disparene as soon as the leaves have opened out and before the blossoms appear, then again as soon as the blossoms fall. Use mist spray. With a few trees in a town lot, the easiest way is to cut off tlhe egg rings and burn them. To keep them from climbing up a tree take a roll of cotton batting, unroll and put once around the

tree, then tie in the middle and pull the top down over the bottom like an umbrella.

Treatment for Tent Caterpillar: Remove the eggs by pruning, or spray with Lime and Sulphur, or destroy the web by burning two whisps of straw or paper beneath it. This should be done in the early morning or late in the evening when the worms are in the web.

THE CONTROL OF PLANT DISEASES.

Aside from injuries caused by insects, plants suffer from diseases of two kinds, viz., those caused by fungi and by bacteria.

There are a number of fungus diseases which often cause serious trouble with some crops, and a knowledge of them and the methods by which they may be controlled is necessary.

In relation to their treatment they may be considered in two classes: Those growing on the surface of the plants, typical of which are the mildews which cause a white downy or powdery appearance on the surface, and those that penetrate the inner tissues of the host, where being protected they flourish. This latter class includes the various rusts, rots, fungus blights, etc., and, in general, are characterized by discolorations of leaf or fruit, by abnormal development. falling away or rotting of affected parts.

Sulphur is the remedy generally used for the fungus diseases in the surface of plants. It may be used as the flowers of sulphur mixed with equal quantity of air-slaked lime and dusted upon affected plants in the morning while the dew is present; or liver of sulphur (potassium sulphide) may be sprinkled on by dissolving it in water. Use it at the rate of one-half to one ounce per gallon. Ammoniacal solution of copper carbonate may be used for these fungi if desired, although the sulphide of potassium is the popular remedy.

Those fungi which penetrate to the internal tissues of plants must be treated in a different manner. The host plant so protects them that no solution can be applied which will destroy the organism causing the disease. Therefore, some means of prevention must be employed.

Knowing that they secure their foothold upon plants by the germination of very minute spores which are produced in great abundance and may be easily carried by the wind, we mnst aim to check their ravages by destroying the spores of life of the

organism immediately after it has germinated. Probably the best means of destroying the spores, is to practice clean culture and remove wherever possible all diseased plants or portions of plants and any rubbish, and have it burned. Careful sanitation is of prime importance and more than pays for itself. Copper compounds in solution will also kill spores and organisms themselves where they can be brought into contact. Copper in solution, however, will burn tender plants, and must have lime added to prevent it. For this reason the spray mixture known as Bordeaux is used. If the directions elsewhere printed are carefully followed, no trouble will be experienced, and the best of results will be attained whether the mixture is used in the orchard or garden.

In growing vegetabes considerable care is necessary in the selection of seed and plants to prevent the increase of fungus troubles. Plant them in soil which has not grown the same nor related crops for several years. In this manner the spores of fungus diseases liable to attack the crop will probably not be present in the soil, and there is little danger of their becoming abundant.

When fungus diseases of certain vegetables are prevalent in a district, spray these crops frequently with Bordeaux Mixture, starting the spraying before the disease makes its appearance, thus preventing the disease getting a start.

After removing the crop clean up all rubbish left in the field and burn it.

Bear in mind, that whenever it is desired to spray for fungi without discoloring the fruit or foliage, the ammoniacal solution of copper carbonate may be substituted for Bordeaux Mixture, although it does not act quite as effectively and costs a little more.

An apparently new disease called by the United States Entomologists "Brown Spot of the Apple," has made its appearance in Montana. The disease has been observed at Thompson Falls and at or near Columbus, Mont. It is a fungus disease which attacks the cambium layer (inner bark). It is first manifest in small brown spots which appear in the inner bark, these gradually spread and the limbs attacked wither and die. The disease spreads slowly, a portion of the tree affected often remaining alive for as much as two years. So far as known it

affects the apple only. All affected branches should be cut out and the tree sprayed with Bordeaux Mixture. Disinfect the saw or knife used and burn all cuttings.

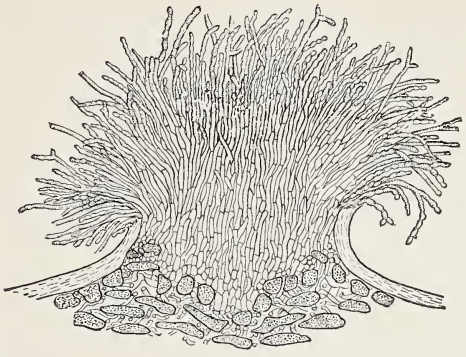
We have now seen how the fungus diseases spread and are favored or hindered by certain conditions. Let us look at the factors which aid or check the development of the bacterial diseases.

Considering the common Pear Blight as typical of the germ diseases it is only necessary to say that they work upon the interior tissues of the plants, thus making it impossible to reach them with a spray. In fact, the only treatment which is advised is careful orchard sanitation. This emphasizes the cutting away and destroying of all diseased parts in order to check further spread as much as possible.

PEAR BLIGHT.

This disease is very common and serious in some states, and is distinguishable by the following symptoms, and works in the manner described. The leaves, generally on the ends of rapid growing twigs or younger parts, become suddenly wilted and droop. Then the whole end of the twig wilts and wrinkles and the leaves become stiff and turn gradually brown, looking as though they had been scorched by fire. Dark, discolored and wrinkled areas appear on the bark sometimes at a considerable distance below the point at which the leaves are killed, and from these spots the sap oozes out and runs down the limb.

When the above conditions are noticed either on pear or apple trees, it may be relied upon that "Pear Blight" has made its appearance in your orchard, and, with a climate exceedingly favorable for its development, it is more than likely that all the pear trees in the neighborhood will be killed, and pear growing will be a dead industry. There is nothing that we can recommend as a treatment for this disease with any certainty of its being successful. It being a germ disease, as heretofore explained, it lives inside the tissues of the host plant, making it impossible to use any germicide as a cure. If, when the disease is noticed, those parts affected are cut away, cutting well back into the sound wood a foot or so below any symptoms of the disease, and the parts cut out carefully gathered and burned, the chances of the disease spreading further are much lessened.



BROWN ROT OF CHERRY—enlarged. [Sclerotinia [Monilia] Fructigena, Pers.] U. S. Dept. Agr.

BROWN ROT OF PEACH, PLUM, CHERRY, ETC.

It sometimes happens that at the time the above fruits are ripening, warm, sultry weather is experienced. This often causes the fruit to turn brown, soft and rotten in a very few hours. The reason for this is that a fungus exists in the orchard, and the weather conditions were such as to cause the spores to germinate, and the growth of this fungus in the fruit caused it to rot. If this condition should occur, the trees should be sprayed with the ammoniacal solution of copper carbonate. This solution is recommended because it does not discolor the leaves or fruit, and as the disease occurs generally just before picking time, it is impracticable to use the Bordeaux Mixture, which contains lime.

POTATO BLIGHT.

The late fungus blight is the most common and causes considerable damage sometimes. It is spread and carried over the winter by spores, which fall upon the ground from the blighted tops, hence, these should be raked up and burned. The disease may be recognized by the discolorations which occur on the leaves. They are at first yellow and later brown, and finally the leaf dies and becomes dry and hard. When the spores fall to the ground the tubers become infected, and the center shows a dry rot later in its development.

Remedies: Careful spraying with Bordeaux Mixture through the season will check its development. Begin spraying in those districts where it is known to abound before it makes its appear-

ance, and continue at intervals of two or four weeks until the potatoes are ripe.

CURRANT LEAF-SPOT.
(Currant Rust.)

This disease manifests its presence by the appearance of spots irregularly scattered over the leaves. They are evident both above and below, are soon whitish or grayish at the center and are surrounded by a brown ring. They show at first as very small brown dots of indefinite outline, but the pale center appears when they are not more than .04 inch in diameter. They increase about .28 inch in diameter when isolated, maintaining a more or less circular outline, but when abundant become confluent, forming large discolored areas often involving most of the leaf. Their general appearance is much like that of the rust spots of strawberry leaves, and they are caused by a similar fungus parasite.

The bushes become deprived of most of their leaves long before the proper season, and the new growth is thus shortened and the buds for the next season are enfeebled.

Treatment: Spray the naked bushes with Bordeaux Mixture early in spring before the leaves unfold, and again several times at intervals during the growing season.

BLACK KNOT.

Attacks plum and cherry.

Produces large, wart-like, black growths along the twigs and branches. Affected limbs gradually swell up, generally more on one side than on the other, until finally the bark where most distended breaks apart and reveals the cause of the swelling in a spongy mass which now pushes up between the edges of the ruptured bark and at length becomes thicker, it may be, than the limb itself. It is at first of an olive color, with felt-like surface, and retains this color for some time, the growth meanwhile extending along the limb for several inches, or in some cases for a foot or more. When old, the growth becomes a dull coal-black, and the uneven, slightly granular surface becomes broken by deep fissures.

Treatment: Prune away the affected parts and burn the cuttings. Spray with Bordeaux Mixture or with Lime and Sulphur.

RASPBERRY ANTHRACNOSE.

(Blackberry Anthracnose, Raspberry and Blackberry Cane Rust)

Attacks raspberry, blackberry, and other plants of the genus Rubus.

Appears on the canes at or near the ground as very small purple spots, which spread and soon acquire a grayish-white center and finally grow to a large size, then with a clearly defined purple rim; often uniting and covering much of the bark; spreads to the petioles of the leaves when abundant and eventually to the leaves themselves, occasionally even to the fruit; spots often a quarter of an inch in diameter; not penetrating the wood to any distance; surface opaque, slightly ribbed longitudinally when old, and assuming a scab-like character; when at an advanced stage splitting, and admitting water so as to cause rot to extend into the underlying wood. Due to a well known fungus, which causes the scab spots by attacking the bark, in which it remains dormant over winter. Young shoots attacked by spores as soon as they appear in spring and most of the growth and development takes place during the growing season, dwarfing the growth and reducing quality and yield of berries. If bad, berries shrivel up about picking time, and often the canes die if the disease is of long standing.

Treatment: Same as for Black Knot, except that the spraying must be done at frequent intervals.

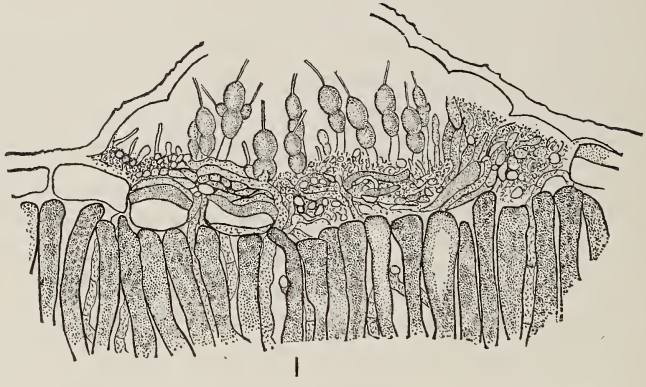
RASPBERRY CANE BORER.

After the raspberry crop is taken off it is often noticed that the ends of many of the branches are drooping, and often the injury is laid to careless pickers. It is caused, however, by the raspberry cane borer, and as the eggs are laid in June in the tender new growth their drooping condition is the first indication of the presence of the pests.

The eggs are laid between two rows of punctures about half an inch apart, which are made by the female, which gnaws the wood to stop the flow of sap in the canes and thus hinder the growth, being done, evidently, so that the growth of the cane cannot dislodge or disturb the eggs in any way. The double row of punctures extends entirely around the cane, and as soon as the worms hatch they eat their way into the center of the stalk, following the soft pith downward until the root of the plant is

reached, which is usually not until fall.

The only positive remedy known is to watch the bushes closely, and on the first appearance of the trouble see that all diseased canes are cut and burned before the worms begin their downward journey. By doing this no trouble is experienced, as the loss of the cane is only what should be done during the summer to cause the next year's bearing canes to branch. Or if the injury is done to a cane of this year's bearing wood, it will have to be cut out, anyway, while if the borer is allowed to get to the root the whole plant will soon succumb.



LEAF BLIGHT OF PEAR—enlarged. [U. S. Dept. Agr.]

PEAR LEAF BLIGHT.

Is caused by a fungus; produces small round spots on the foliage, and causes the leaves to drop early in the season. It also produces ugly hard spots on the fruit, frequently causing it to crack open. It is readily preventable by spraying with Bordeaux Mixture, about three treatments being necessary. The first should be made about three weeks after the bloom sheds, and the other two at intervals of two weeks. This trouble should not be confused with the disease called pear or "fire" blight, which attacks the limbs of trees.

CROWN GALL.

Crown Gall has been very injurious to Montana nursery stock, and the following article by J. W. Toumey, Experiment Station, Arizona, is of especial value.

"Crown Gall is a disease very injurious to deciduous fruit trees, particularly so to the almond, apricot, peach, plum and

CROWN GALL.

nectarine. The same, or closely allied galls, have been found upon the roots of the apple, pear, English walnut, grape, raspberry, and a number of other plants, both cultivated and wild.

"The disease may be readily recognized by the large knot-like out-growths which develop at the crown of the plant just beneath the soil, or, in older plants, on the roots and rootlets. There is no disease of deciduous fruit trees in irrigated regions that is as widespread and that causes so much injury to the fruit industry as the crown gall. Not only is it prevalent and rapidly increasing in the irrigated regions of southwestern United States, but it is becoming one of the most menacing diseases which threaten the deciduous fruit industry in practically all of the great fruit centers of the United States.

"For the past six years I have had the crown gall under observation, and five years ago, published a preliminary report regarding it, as Bulletin No. 12, of the Arizona Experiment Station. This report was based almost entirely upon observations in the field. Two years ago extensive experiments were begun to ascertain the communicability of the gall. It is sufficient at this time to state, that I have repeatedly produced the disease by inoculation of young seedlings with small bits of the gall,

in some instances the galls beginning to develop twenty days after inoculation.

"Again, I have repeatedly produced the gall on almond seedlings by planting the seeds in sterile soil, and at the time of planting placing a few pieces of minced gall in the soil.

"There is no question regarding the communicability of this disease; it is contagious. The disease is probably caused by a micro organism known as a "slime fungus;" the plasmodia of the organism, through irrigation, causing the galls to develop. Under certain conditions the plasmodia creep to the surface of the gall and form minute amoeba-like bodies which slowly make their way through the damp soil to other plants.

"Knowing the nature of the disease, the question with the fruit grower is how to eliminate it from the infested orchards. The best advice that I can give to those intending to plant trees, is to get trees from a nursery that is absolutely free from the crown gall. It is not sufficient to cast aside as worthless only those trees with galls upon their roots. Every tree that comes from an infested nursery is dangerous, and when such trees are planted, great chances are taken. If your orchard is already infested with crown gall, you cannot entirely get rid of it. All that you can do is to hold it in check and keep the galls as much as possible from the crowns of the trees. When it appears on the main stem of a tree a few inches below the ground, that is, at the crown, as it frequently does, particularly on young trees, it is almost certain in time, if unchecked, to cause the death of the tree. As this disease only affects the tree at the point where the gall develops and in the adjacent tissue, if the gall be removed and something applied to the wound to prevent additional growth, it can be held in check, and a minimum amount of harm will come to the tree from its action.

"From a number of experiments carried on in the greenhouse, where a large number of seedlings have been under experiment for the past two years, it has been shown that bluestone is of marked value in the treating the disease. In the field the following has proved to be the most successful of any treatment as yet known. The remedy should be applied in October and November or in March and April, as at these periods of the year the growth of the gall is the most rapid."

"Two parts of blue-stone;

"One part of copperas;

"Three parts of quicklime.

"Crush the bluestone and copperas to a fine powder, thoroughly mix with the lime, and add enough water to make a thick paste. In treating the disease the crown of the trees should be exposed, all the galls cut away, and a quantity of the paste plastered over the wounds. This remedy prevents the growth of the soft, spongy tissue infested by the plasmodia. It is very important that all the galls cut from the trees be gathered and burned."

INSECTICIDES AND FUNGICIDES.

Practically speaking all insects are divided into two groups, and in order that one may know what remedy to use for any particular insect the following is given:

Group 1. Includes all biting or leaf-eating (mandibulate) insects. For these the following food poisons are given:

Paris Green.

Paris Green	1 pound
Quick Lime	1 pound
Water	150 gallons

Stir the poison into a thin paste with a little water, slake the lime and strain the mixtures through a sieve into the vessel holding the required amount of water. Agitation is necessary while operations are going on, as Paris Green is not very soluble in water and the small granules rapidly sink to the bottom of the vessel.

Arsenate of Lead.

Arsenate of Soda	4 ounces
Acetate of lead	11 ounces
Water	100 gallons

Dissolve the Arsenate of Soda in two quarts and the Acetate of Lead in one gallon of warm water.

An especially valuable remedy for spraying very delicate foilage or for use against insects which are killed only by large doses of poison, since it can be used upon plants in much stronger solutions than the other food poisons, without injury to the foilage.

The Bowker Insecticide Co. of Boston, Mass., offers this preparation for sale through the Portland Seed Co. of Spokane,

Wash., through which agency the Montana State Board of Horticulture has secured its last supply.

Lime and White Arsenic.

White Arsenic .....1 pound
Lime .....2 pounds
Water .....2 gallons

Slake the lime and then boil the ingredients together for one hour. For use, dilute with 300 gallons water.

Additional lime in the solution may be necessary to prevent burning of the foliage. Great care is necessary in the preparation of this remedy.

For All Sucking Insects—Contact Insecticides.

Group 2. Comprises all the sucking (haustellate) insects, which insert their beaks into the leaf tissues, bark or fruit and suck the juices. For these the following remedies are given:

Kerosene Emulsion.

Kerosene Oil .....2 gallons
Laundry or Whale Oil Soap .....1 pound
Water .....1 gallon

Dissolve the soap in boiling water, and while still hot add the kerosene, taking care to keep the latter away from the fire.

Agitate the mixture violently until it becomes a thick, creamy mass. If perfectly made, will stand indefinitely without free oil rising to the surface.

This will be found to be an efficient remedy for green aphis, wooly aphis, red spider, mealy bugs and certain scale insects.

Whale-Oil Soap and Quassia Chips.

Boil for two hours one pound quassia chips in water.

Dissolve in warm water one pound of whale-oil soap. Mix the two solutions and use in six gallons of water.

Most effective spray in summer for use against aphis.

Lime, Sulphur and Salt.

Lime .....15 pounds
Sulphur .....15 pounds
Salt .....15 pounds
Water .....50 gallons

Slake the lime thoroughly, add the sulphur, cover with water, and boil briskly for at least an hour. Then add the salt and boil for 15 or 20 minutes longer. Add water to make 50 gallons.

Apply with considerable force through a coarse nozzle while

still warm. Experiments show that the salt adds nothing to the efficiency of this spray.

Lime-Sulphur-Caustic Soda Wash.

Lump Lime .....30 pounds
Sulphur .....15 pounds
Commercial Caustic Soda .....4 to 6 pounds
Water .....50 gallons

Slaken the lime in the required vessel.

Tobacco.

Hard Soap (preferably Whale-Oil)....1 pound
Water .....8 to 10 gallons
Strong Tobacco Decoction .....1 gallon

Dissolve the soap in boiling water, add the tobacco decoction and dilute to 8 to 10 gallons.

FUNGICIDES.

Bordeaux Mixture for Dormant Plants.

Bordeaux Mixture is perhaps the most generally useful of all spraying compounds. It is the principal remedy for fungus diseases, is of some value as an insecticide, has a beneficial effect upon plants independent of its effect upon their insect and fungus parasites and may be used for most purposes in place of water in the preparation of the arsenical sprays.

Bordeaux for winter use may be made as follows:

Copper Sulphate .....6 pounds
Unslaked Lime .....4 pounds
Water .....50 gallons

Bordeaux Mixture for Plants in Foliage.

Copper Sulphate .....4 pounds
Unslaked Lime .....6 pounds
Water .....50 gallons

For a stock solution dissolve any number of pounds of copper sulphate (blue vitriol) in as many gallons of water by suspending in a burlap sack, so that the sulphate just touches the surface of the water. Keep the stock solution in a stoppered jar. Use an earthen or wooden vessel in the preparation of Bordeaux Mixture, as it will ruin a vessel of metal.

In some vessel slake slowly five pounds of fresh lime, using hot water, gradually adding water until a thin whitewash is formed. Take four gallons of the copper solution above and add

to 25 or 30 gallons of water. To this solution add through a strainer the lime whitewash as prepared, adding sufficent water to make 40 or 45 gallons, stirring vigorously the while. Keep the mixture agitated while spraying.

BORDEAUX MIXTURE AS AN INSECTICIDE AND A FUNGICIDE.

By adding one-quarter pound of Paris Green to each fifty gallons of Bordeaux, the mixture becomes a combined insecticide and fungicide. Or, arsenate of lead may be added instead of Paris Green—two or three pounds of the arsenate to fifty gallons of Bordeaux. Arsenate of lead, called Disparene, unlike Paris Green, will not burn the foliage when applied in large quantities; and it "sticks" better.

FINALE.

The business of fruit-growing is a matter of such infinite detail, requiring such a wide range of knowledge, that had Solomon lived to the age of Methusala, devoting his life to horticulture, he would still have had something to learn of the business, and the few suggestions in this report are offered for the benefit of those who are new in the work, and not as an exhaustive treatise on fruit-growing.

Respectfully submitted,

FRED. WHITESIDE,

Secretary Montana State Board of Horticulture.

Montana Horticultural Law.

An Act to Create the Montana State Board of Horticulture, to Prescribe Its Powers and Duties, and to Appropriate Money Therefor.

Be It Enacted by the Legislative Assembly of the State of Montana:

Section 1. There is hereby created a State Board of Horticulture, to consist of seven members, six of whom shall be appointed by the Governor, one from each of the horticultural districts that are hereby created, and the State Executive who shall be an exofficio member of the board. No person shall, however, be appointed on said board, or employed by them, who shall be connected in any way with any nursery, or who shall be engaged in the sale or handling for profit of any nursery product.

Section 2. The State shall be divided into the following horticultural districts: The first district shall comprise the counties of Dawson, Custer, Yellowstone, Sweet Grass, Carbon, Park and Rosebud; the second district shall comprise the counties of Gallatin, Madison, Jefferson, Beaverhead, Silver Bow, Lewis and Clark, Meagher and Broadwater; the third district shall comprise the counties of Cascade, Fergus, Valley, Choteau and Teton; the fourth district shall comprise the counties of Missoula, Granite, Powell and Deer Lodge; the fifth district shall comprise the county of Ravalli; and the sixth district shall comprise the county of Flathead.

Section 3. The members shall reside in the district for which they are appointed. They shall be selected with reference to their study of, and practical experience in horticulture, and the industries dependent thereon. They shall hold office for a term of four years, and until their successors are appointed and qualified, provided, however, that two of the board first appointed—to be determined by lot—shall retire at the expiration of two years. All vacancies in the board shall be filled by appointment

of the Governor, and shall be for the unexpired term.

Section 4. The board is authorized to employ a secretary and prescribe his duties, who shall hold his appointment at the pleasure of the board, Before entering upon the discharge of his duties, each member and employe of the board shall take and subscribe to the oath of office, which said oath shall be filed with the Secretary of State.

Section 5. The board may call together and hold, in conjunction with horticultural societies, public meetings of those interested in horticulture and kindred pursuits, and may publish and distribute such proceedings and discussions as in its judgment may seem proper, provided the sum so expended shall not exceed the sum of $300 per annum.

The board shall meet on the third Monday of February and September of each year, and as much oftener as it may deem expedient.

Section 6. The office of the board shall be located at such place as the majority thereof may determine, and shall be in charge of the Secretary during the absence of the board.

Section 7. For the purpase of preventing the spread of contagious diseases among fruit and fruit trees. and for the prevention, treatment, cure and extirpation of fruit pests, and diseases of fruit and fruit trees, and for the disinfection of grafts, scions and orchard debris, empty fruit boxes or packages or other suspected material or transportable articles dangerous to orchards, fruit and fruit trees, said board may prescribe regulations for the inspection, disinfection or destruction thereof, which regulations shall be circulated in printed form, by the board, among fruit growers and fruit dealers of the state, and shall be published at least ten days in two horticultural paper of general circuation in the state and shall be posted in three conspicuous places in each county in the state, one of which shall be at the County Court House thereof.

For further prevention of the spread of diseases dangerous to fruit and fruit trees, it shall be unlawful for any person, or persons, dealer, or dealers, to allow, or caused to be used the second time any crate, box, barrel, package or wrapping once having contained fruit or nursery stock, and that the destruction of the same must be made in its entirety, and that the finding of such crate, box, barrel, package or wrapping in possession

of any person or persons, dealer or dealers, other than the consignee, shall be considered prima facie evidence of a violation of this act.

Any member of the .board or officer thereof, is hereby authorized to seize and destroy by burning without breaking such crate, box, barrel, package or wrapping wherever found, and to prosecute said violator or violators.

Section 8. The said board shall elect from their own number, or appoint from without their number, to hold office at the pleasure of the board, one competent person in each district, to be known and act as inspector of fruit pests. Said inspectors shall be selected with reference to their study, and practical experience in horticulture. It shall be the duty of such inspectors to visit the nurseries, orchards, stores, packing houses, warehouses and other places where horticultual products and fruits are kept and handled within their respective districts, and to see that the regulation of the State Board of Horticulture to prevent the spread of fruit pests and diseases of trees and plants, and the disinfection of fruits, trees, plants, grafts, scions, orchard debris and empty fruit boxes and other material shall be fully carried out and complied with. Said inspectors shall have free access, at all times, to all premises where any trees, plants, fruits or horticultural products or supplies are kept or handled, and shall have full power to enforce the rules and regulations of the State Horticultural Board, and to order the destruction of any or all trees, plants, fruits or horticultural products or supplies found to be infected with any diseases as prescribed. or designated by said board.

The said board may appoint one or more, as necessary, competent persons, to be known as Special Inspectors, whose general powers and duties shall be regulated and prescribed by the member of the board for that district. Such special inspector shall receive such sum per day, as the said Board of Horticulture may agree upon, provided such sum shall, in no case, exceed the sum of five dollars per day, for the time actually employed.

The said board shall appoint one person to be known as Inspector at Large for the State, whose duties shall be prescribed by the board, and who shall receive the sum of five dollars per day for the time actually employed.

Section 9. It shall be the duty of every person or persons, corporation or corporations, who shall sell or deliver to any person or persons, corporation or corporations, any trees, plants, vines, scions or grafts, to notify the secretary of the board, whose duty it shall be to notify the inspector of said district wherein such vines, etc., etc., are to be delivered at least five days before said goods are to be delivered, giving the date and nursery, or railroad station where said trees, plants, scions, etc., etc., are to be delivered, together with the name of the party or parties who are to receive the same. It shall be the duty of the inspector receiving said notice, to inspect said trees, plants, scions, etc., etc., as soon thereafter as practicable, and if the same be found free from any and all diseases or pests, as designated by said State Board of Horticulture, he shall so certify and shall attach such certificate to each lot or bill of trees, grafts, plants, scions, etc., which said certificate must contain a list of the said trees, grafts, scions, vines or plants so inspected, But if any of the trees, grafts, scions, vines or plants so inspected shall be found to be diseased or infested with any of the pests, as prescribed by the said board, then the inspector shall order the disinfection or destruction of said trees, grafts, scions, vines, etc., etc., etc., so diseased or infected, together with all boxes, wrapping or packing pertaining thereto, and charge and collect the sum of ten dollars ($10) for the disinfection and inspection of each carload of said nursery stock, and a proportionate sum for less than car lots, but in no instance for less than $2, for each separate inspection or disinfection, provided, that the State Board of Horticulture shall have power to designate certain places as quarantine stations, where all nursery stock brought into the state shall be inspected and disinfected.

For the inspection of fruit, a fee of two cents per box or package with a maximum fee of five dollars for each separate lot or car shall be charged and collected. The inspectors shall collect such fees and shall not give certificates of inspection until the fees are paid.

Section 10. If any person or persons in charge or control of any nursery, orchard, storeroom, packing house or other place where horticultural products or supplies are handled or kept, shall fail or refuse to comply with the rules and regulations of the said State Board of Horticulture, or shall fail or refuse to

disinfect or destroy any diseased or infected trees, plants, scions, vines, grafts, shrubs or other horticultural supplies or products, when ordered so to do, by the inspector of such district, he shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in any sum not less than $25 nor more than $300.

Section 11. It shall be the duty of every owner or manager of every orchard, nursery, storeroom, packing house or other place where horticultural products or supplies are kept or handled, which shall become diseased or infected with any injurious insect or pest, to immediately upon discovery of the existence of such disease or pest, to notify the inspector of said district of the existence of the same. It shall be the duty of such owner or manager at his own proper expense, to comply with and carry out the instructions of said inspector for the eradication of any disease or pest. Any person who shall fail or refuse to notify said inspector as herein provided, or who shall fail or refuse to comply with the instructions of said inspector for the eradication of any disease or pest, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in any sum not less than $25 nor more than $300.

Section 12. If any person or persons, corporation or corporations, shall fail or refuse to forthwith comply with the instructions of said inspector, for the eradication of any disease or pest, said inspector shall proceed forthwith to eradicate such disease or pest and the expense of the same shall become a charge and a lien upon the property of such owner.

Section 13. Every person who for himself or as agent for any other person or persons, corporation or corporations, transportation company or common carrier, shall deliver or turn over to any person or persons, corporation or corporations, any trees, vines, shrubs, nursery stock, scions, grafts, without first having attached the inspector's certificate, as provided in Section 9 of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than $25 nor more than $300.

Section 14. No person or persons, corporation or corporations, shall be liable to any other person or persons, corporation or corporations for any damage to any trees, vines or shrubs, nursery stock, scions or grafts by reason of the same being held

to await the certificate of the inspector, as provided in Section 9 of this act.

Section 15. The inspectors of fruit pests appointed or selected by said board shall receive as compensation for their services such sum as the board may regulate, provided, not to exceed five dollars per day for the time actually employed. The members of said board shall receive no compensation for their services, except actual expenses paid out. The secretary of said board shall receive the sum of $1,000 per annum for his services.

Section 16. All bills for expenditures, under this act, shall be audited and passed upon by said Board of Horticulture, and if found legal and just, shall be allowed, subject to the approval of the State Board of Examiners, and a warrant shall be drawn therefor upon the Auditor of the State of Montana, who shall draw his warrant upon the State Treasurer therefor.

Section 17. It shall be the duty of the Secretary to attend all meetings of the board and procure records of the proceedings and correspondence, to collect books, pamphlets, periodicals and other documents containing valuable information relating to horticulture, and to preserve the same; to collect statistics and other information showing the actual condition and progress of horticulture in this state and elsewhere; to correspond with agricultural and horticultural societies, colleges and schools of agriculture and horticulture and other persons and bodies as may be directed by the board, and prepare, as required by the board, reports for publication; he shall also act as assistant to, and obey the directions of the inspectors of fruit pests, under the direction of the board.

Section 18. The board shall biennially, in the month of January, report to the legislature a statement of its doings and abstracts of the reports of the inspectors of fruit pests, and of the secretary.

Section 19. There is hereby appropriated for the use of the State Board of Horticulture as set forth in this act, out of the moneys in the state treasury, not otherwise appropriated, the sum of seven thousand dollars, $3,500 or so much thereof as may be necessary for the year commencing December 1, 1904, and $3,500 or so much thereof as may be necessary for the year commencing December 1, 1905.

Section 20. All sums of moneys collected as fines for viola-

tions of any of the provisions of this act shall be turned into the state treasury for use in defraying expenses of the board hereby created, and the appropriations hereby made shall be paid out of the fund to the extent of the money therein contained.

Section 21. Every person who for himself, or as agent for any other person or persons, transportation company or common carrier, shall deliver or turn over to any person or persons, corporation or corporations, any fruits without first having attached the inspector's certificate, shall be deemed guilty of a misdemeanor.

Section 22. No person, firm or corporation shall engage or continue in the business of selling within the state, or importing fruit trees, plants, or nursery stock in to the state, without first having obtained a license to do business in this state, as in this act provided.

Section 23. Any person, firm or corporation may obtain a license to engage in the business of selling fruit trees, plants or nursery stock into this state upon the payment of the sum of twenty-five dollars, and by filing with the Secretary of the State Board of Horticulture, bond with sureties, in the sum of one thousand dollars ($1,000), conditioned that the principals will faithfully obey the laws of the state of Montana, and that the said principals will pay the cost of fumigation of all nursery stock or other materials, or goods imported into or sold within the state by the said principal or his or their agent, and the expense of destruction of any infected nursery stock. License granted under this act shall be for one year, provided, however, that such license may be revoked at any time for any violation of this act, at the discretion of the board.

Section 24. It shall be the duty of every person, firm or corporation licensed to do business under this act to notify the Secretary of the State Board of Horticulture of his intention to ship an invoice of fruit trees, plants or nursery stock, from one point to another in this state, or from any point without this state into this state. The said notice shall contain the name and address both of the consignor and consignee, and the invoice of the goods to be shipped, the freight or express office at which the goods are to be delivered, and the name or title of the trans-

portation company from whom the consignee is to receive such goods.

Such notice shall be mailed at least five days before the day of shipment.

Section 25. It shall be the duty of each person or corporation offering to sell, or selling and delivering, any nursery stock, fruit trees, plants, vines, scions, cuttings, etc., etc., within the state of Montana, to place on each and every package so sold and delivered, a label or card containing the name and address of both the consignor and consignee, and the invoice of the stock therein contained.

Section 26. Any person or persons who shall receive and accept any nursery stock, fruit trees, plants, vines. scions, cuttings, grafts, etc., etc., that have not been inspected by a duly appointed inspector of the State Board of Horticulture, and shall use or dispose of said nursery stock, fruit trees, vines, plants, scions, cuttings, grafts, etc., etc.. without first notifying the inspector and furnishing him opportunity to examine, and if necessary, fumigate the said nursery stock, will be deemed guilty of a misdemeanor and will be subject to a fine as further provided in this act.

Section 27. All nursery stock, trees, plants, vines and cuttings grown or growing within the state of Montana, used for filling orders shall after said stock shall have been taken from the nursery rows or grounds, and before the same shall have been packed for delivery, be inspected by a duly appointed inspector and shall be disinfected by fumigating or other method, when in his judgment such is necessary. After such inspection, if it be found that said nursery stock, trees, plants, vines and cuttings, are clean and free from insects and fungi pests, he shall issue his certificate to said nurseryman, and said certificate shall entitle him to use said stock, so inspected and disinfected for filling orders for the next current delivery.

Nurseries shall give to the Secretary of the board five days' notice of the time when said stock shall be ready for inspection under the provision of this act.

Section 28. Any person or persons, corporation or corporations, transportation companies or common carriers, violating any of the provisions of this act, shall be deemed guilty of a misdemeanor and fined in the sum of not less than twenty-five

dollars ($25), nor more than three hundred dollars ($300).

Section 29. All acts and parts of acts in conflict herewith are hereby repealed.

Section 30. This act shall take effect and be in force from and after its passage and approval.

ACT OF 1907.

Section 1. The Montana State Board of Horticulture is hereby authorized and empowered to establish a quarantine over any orchard or place where fruits are grown or kept, that is infested with any injurious disease or insect pest; and said board may establish such rules and regulations governing such quarantine and regulating or restricting the use of such fruits upon the premises or the shipment or disposition of same as the board may deem necessary to prevent the spreading of such disease or diseases or insect pests.

Section 2. Any person who shall violate the provisions of this Act, or the rules and regulations established by said Board of Horticulture or who shall ship or dispose of any idseased or infested fruit, or fruit products, in violation of the order of said Board of Horticulture, shall be deemed guilty of a misdemeanor and upon conviction thereof, shall be fined in the sum of not less than Twenty-five ($25) Dollars nor more than Three Hundred ($300) Dollars.

Section 3. Whenever under the direction or regulations of the Montana State Board of Horticulture any money is expended by said board for the purpose of eradicating any disease or insect pest from any orchard or other place where fruits are grown or kept, said board through its representative shall notify the owner of such orchard or premises in writing of the amount so expended. Said notice shall be mailed to the last known address of such owner, and if such owner shall fail to pay the amount so expended by said board within thirty days of the time such notice is sent, then and in that event the board shall file a statement verified under oath by its representative with the County Treasurer in the county wherein said money shall have been expended. Said statement shall set forth the amount so expended together with the correct description of the property on which such money was expended as it appears on the assess-

ment roll of the county. The County Treasurer shall add the amount as set forth in said statement to the taxes upon said property and shall collect the same as provided by law for the collection of taxes for state and county purposes.

Section 4. The County Treasurer in any county where any money is collected as provided in Section 3 of this Act, shall on or before the first day of February of each year remit the amount previously collected to the Secretary of the State Board of Horticulture who shall remit the same to the State Treasurer and such remittances, together with all other fees and remittances paid into the State Treasury by the State Board of Horticulture shall be added to the appropriation for the use of the said board in the year in which such remittances are made and all such remittances shall be credited to the fund for the use of the State Board of Horticulture.

Section 5. All Acts and parts of Acts in conflict with this Act are hereby repealed.

Section 6. This act shall be in full force and effect from and after its passage and approval.

RULES OF THE MONTANA STATE BOARD OF HORTICULTURE.

Rule 1. The term nursery stock is construed to mean and include fruit, shade and ornamental trees (deciduous or evergreen), shrubs, vines, plants, roots and bulbs, scions, cuttings, or other portions of plants, shrubs or trees designed to be re-planted in Montana for home or commercial use.

It shall be the duty of the inspector after receiving notice of the arrival of any nursery stock to immediately have the same inspected or fumigated and he shall, if he finds after inspection, said nursery stock free from any and all diseases, place his certificate upon each and every package showing that the said nursery stock has been inspected or fumigated, giving name of the inspector, the date of inspection and place, but if the said nursery stock be found to be infected with any of the diseases or insects injurious to orchards as prescribed by the Board of Horticulture, other than the San Jose Scale. Wooly Aphis, Black Knot of Plum, Black Knot of Cherry, the said diseased stock shall be properly treated, but if the said nursery stock shall be infected with San Jose Scale, Woolly Aphis, Black Knot of Plum, Black Knot of Cherry, Crown Gall or Root Knot. then the inspector shall destroy the same by burning; together with all wrapping and packing, and shall issue a certificate to the shipper or owner showing cause for destruction.

Rule 2. All nursery stock, trees, plants, vines and cuttings of any kind shipped into or brought into the State of Montana, before delivery to the purchaser, shall be unpacked from the boxes, and in case of baled or burlapped shipments, these coverings shall be removed and stock shall be inspected and fumigated at Miles City, Billings, Dillon, Missoula, Kalispell, Great Falls, Glasgow, Troy, Plains and Thompson Falls, which points are hereby designated as quarantine stations.

All nursery stock, trees, plants, vines and cuttings brought into Montana by any transportation company, shall be inspected and fumigated at the point of delivery, provided said point of delivery shall be one of the above designated quarantine sta-

tions, but if any shipments shall be filled for delivery at any other points in Montana, they shall be inspected or fumigated at the quarantine station on the line of such transportation company next preceding or nearest the point of delivery to which they are billed.

All such nursery stock, plants, trees, vines, cuttings, brought into the state of Montana by wagon shall be inspected and treated at the nearest quarantine station, as hereinbefore mentioned, to the point where such nursery stock, trees, plants, vines and cuttings enter the state.

The certificate of the inspector making such examination and inspection shall exonerate the shipper and consignee from any and all penalties provided by law.

Rule 3. Importers or owners of nursery stock, trees, vines, plants and cuttings, who shall desire to have such nursery stock, trees, plants, vines and cuttings inspected and fumigated at points in Montana other than the regular quarantine stations, may have such inspection and fumigation made at any point designated by such importer or owner; provided, however, that such importer or owner shall pay all charges of inspection and fumigation, and all expenses of the officer employed in such inspection and fumigation, such charges and expenses to be paid before the certificate is granted.

Rule 4. The Inspector at Large shall have authority to employ labor to assist the inspectors in any district whenever in the judgment of such Inspector at Large such assistance is necessary.

Rule 5. It shall be unlawful for ,any person to spray any tree, plant, or shrub, when the same is in bloom, with any substance injurious to bees or honey.

Rule 6. All special inspectors shall be appointed by the Inspector at Large, and shall hold office at his pleasure. All inspectors shall report to the Secretary at least once a month, or as often as directed by said Secretary.

Rule 7. Every inspector engaged in work for which no fees are prescribed by law, shall receive for such work the sum of Three Dollars per day for each day actually employed. Bills for all such work shall be audited by the President or Secretary and forwarded to the State Board of Examiners for payment.

Rule 8. All inspection and fumigation shall be under the

charge and supervision of the Inspector at Large and all inspectors shall be responsible to him.

Rule 9. The inspectors appointed by this board and the special inspectors appointed by the inspector at large, are authorized to inspect in their respective districts any and all nursery stock, trees, plants, shrubs, vines and fruits, and to collect the fees prescribed in the law, from the owner or person in control of such nursery stock or fruits wherever found.

Rule 10. The inspector in each district shall receive a compensation for the inspection of fruits and nursery stock the sum total of all fees collected for such inspection; provided, however, that the same shall not exceed the sum of $5.00 per day for each day's work devoted to inspection, and all the fees in excess of said sum shall be transmitted, with the report of the inspector, to the Secretary.

Rule 11. The Inspector at Large shall have authority to go or send a competent person outside of the state to inspect any fruits or nursery stock to be shipped into the state whenever the party asking for such inspection shall defray the entire expense of such proceeding.

Rule 12. A quarantine is hereby established over any orchard or place where fruits or nursery stock are grown or kept that is or may become infested with any injurious disease or insect pest, and the Inspector at Large is authorized and directed to enforce such quarantine against any orchard or place where any such disease or insect pest is or may be hereafter found. The Inspector at Large shall notify the owner or person in control of such orchard or place in writing of the establishing of such quarantine and thereafter such owner or person in control shall not ship or remove or allow to be shipped or removed, any fruit, nursery stock or other material, except by the written permission of the Inspector at Large. The owner or person in control of any such orchard or place may be permitted to use any such fruit or material upon the premises under the instructions of the Inspector at Large.

By fumigation it is to be understood treatment by hydrocyanic gas. This treatment shall be done as follows: All nursery stock to be treated should be placed in an air tight tent or box. For every one hundred cubic feet of space in box or tent, take one ounce, avoirdupois weight, and fused potassium cyanide, 98 per

cent strength, preferably in lumps about the size of a walnut; one and one-half ounces commercial sulphuric acid, best grade, and two and one-fourth fluid ounces of water. First: Place the water in a three gallon vessel (which may be glazed earthenware); to this add the acid and finally the potassium cyanide. (The cyanide would be better enclosed in a small paper bag in which a hole is torn.) Immediately close the doors or openings, taking all precautions against inhaling the gas, as it is one of the most violent poisons known. After leaving box or tent closed for forty minutes, open all doors and allow at least one hour for thorough ventilation before attempting to remove stock. No injury is caused to nursery stock if the gas is left in for more than forty minutes.

Fifth Biennial Report

OF THE

Montana
State Board of Horticulture

TO THE

Legislative Assembly

OF THE

STATE OF MONTANA
For the Years

1907-1908

"INDEPENDENT PUBLISHING COMPANY, HELENA, MONTANA."

OFFICERS AND MEMBERS OF THE BOARD.

JOHN G. CLARK,
First District, Fromberg.

T. T. BLACK,
Second District, Whitehall.

R. N. SUTHERLIN,
Third District, Great Falls.

T. A. McCLAIN,
Fourth District, Carlton.

WILLIAM J. TIEDT,
Fifth District, Darby.

J. C. WOOD,
Sixth District, Big Fork.

C. C. WILLIS,
Seventh District, Plains.

HON. EDWIN L. NORRIS,
Ex-Officio Member, Helena.

C. C. WILLIS,
President and Inspector at Large.

JOSEPH W. WALLISCH,
Secretary. Office Room 33, Hirbour Block, Butte.

LETTER OF TRANSMITTAL.

Office of State Board of Horticulture,
Butte, Montana, January 1, 1909.

To His Excellency,
Edwin L. Norris,
Governor of Montana.

In accordance with law I have the honor to submit the Fifth Biennial Report, Volume V, of the Montana State Board of Horticulture for the years 1907 and 1908.

JOS. W. WALLISCH, Secretary.

PREFACE.

In this report routine matters and statistics of doubtful interest have, so far as possible, been omitted, and the endeavor made to confine the report to matters of value to those interested —both directly and indirectly—in fruit growing.

Besides a review of the work done by the State Board of Horticulture and statistics showing the volume and character of business done in Montana in the fruit industry, other information, formulas and tables deemed to be of value to fruit-growers, have been included in this report, the purpose being to help in a practical way those engaged in the business.

Report of the Montana State Board of Horticulture.

To His Excellency,
Edwin L. Norris,
Governor of Montana.

To the Governor and Legislative Assembly of the State of Montana:

In compliance with the provisions of the law, I have the honor to submit for your inspection the following report of the work of the State Board of Horticulture and its officers and appointees for the years 1907 and 1908:

REVIEW.

The present secretary was elected to the position by the Board on March 11, 1907. At the same meeting in March the following became members of the board by appointment by the Governor: John G. Clark of Fromberg, T. A. McClain of Carlton, C. C. Willis of Plains.

The vacancy in the Sixth District, Flathead County, caused by the resignation of Mr. Fred Whiteside, was filled by the appointment of Mr. J. C. Wood of Big Fork, by the Governor on May 6, 1908. At a special meeting of the Board held on March 18, 1908, Mr. C. C. Willis was elected president and inspector at large to succeed Mr. Fred Whiteside, resigned.

The same course pursued by the former secretary was followed without relaxation. With a quarantine law enacted at the session of the legislature in 1907 the board was in a position to control the spread of pests and diseases, which it did, and the wisdom of such needed legislation was at once apparent, as it proved of inestimable value to the industry in the State. Under its provisions the careless orchardist and small grower of a few trees who had any infestation of fruit pests or any infectious or injurious diseases, was quarantined and compelled to follow the directions of the party authorized and empowered to establish such quarantine, to rid his trees of the pest or disease, as the case might be. A number of such quarantines have been enforced and

the beneficient results to the board and the industry, figured in dollars and cents, are vast. Under this law much needed work was done, especially in the spraying line under the supervision of the board, and the expenses therefor were collected by the county treasurer in most cases with other taxes and remitted to this office and in turn sent the state treasurer. All such remittances are shown in the report of the appropriation fund, which appears on another page.

The rigid inspection of fruit and nursery stock resulted in some friction, and much stock was condemned, but the markets showed the good results accomplished thereby. The general average of fruit shipped into Montana the last year has been cleaner than in previous years, particularly in the peach and pear line. I can account for this on the theory of the prevailing dry season in other parts of the country, as fungus diseases thrive only in wet seasons. In support of this we have the appearance of Apple Scab, in sections of the State, where this disease was hitherto unknown. For the spring of 1908 was the wetest and most disastrous on account of floods and washouts, to the greater portions of our State. However, the board has coped with the disease with satisfactory results, except in the Lake region of the Flathead, where the infection has existed for some time, but it is receiving all care and attention towards its reduction and ultimate eradication.

The Oyster Shell Bark Louse Scale and Coddling Moth, in the western part of the State, has received the usual care and attention and has been considerably reduced. Experience has demonstrated that more than one spray of lime, sulphur and salt is required for the Oyster Shell Bark Louse Scale, and this will be undertaken in the future. While the Pear Blight has been eradicated in some parts of the State, we find that in other parts it has developed for the first time, due to the excessive moisture of the spring of 1908. It is more difficult to control in apple than in pear trees. Heroic measures will be used to combat it in the virgin territory. Each year brings to us an increase in the industry, and on account of the vast territory covered the expense of orchard inspection and spraying is becoming greater. Many orchardists, not familiar with pests and diseases, requested orcahrd inspection, etc., which they should have, but for lack of funds sufficient to cover the necessary work, many such requests had to be denied. I would therefore suggest an increase

in our appropriation in order to insure a more systematic and successful warfare against the further invasion of fruit pests and diseases, and the extermination of those now existing in orchards in the State. Orchard inspection has been carried on partly, as far as our present means would permit, in virgin country. The orchardists visited have been glad to avail themselves of the necessary information and follow the orders of pruning, spraying, &c., according to the practical demonstrations given them by the visiting inspector, spraying, pruning and the required treatment of pests and diseases being unknown to many. Wooly Aphis, of the root attacking form, has been found in some orchards by the inspectors and the Green Aphis was reported as troublesome in some sections. In each case a practical demonstration was given, how to successfully combat them. Other minor pests and diseases were found and treated. While these have not done any great harm they require attention, for a few dollars now spent will save us hundreds in the future. The Codling Moth, being the worst pest known to the apple industry, has received the usual care and attention of the board. It has been reduced in most places and in others practically exterminated. As new infection may occur at any time, we are prepared to meet it. At the present time the board has five power sprayers, which are being used in the commercial apple sections. Their use has stimulated others to purchase individual sprayers. The usual banding of trees was carried on and a record kept thereof. In Missoula County in 1907 there were 5,250 trees sprayed; 4,110 bands used; 2,530 trees banded, and 16,334 worms found under bands, a decrease of 28 per cent in 1907 over 1906.

The figures for 1908, to determine the decrease of worms in 1908 over 1907 are not available at the time this report is made.

RECEIPTS AND DISBURSEMENTS "APPROPRIATION FUND" FOR FISCAL YEAR ENDING NOV. 30, 1907.

Receipts.

Appropriation, 1907	$ 4,000.00
Remittances to State Treasurer, fees collected, etc	614.60

Disbursements.

General Expenses:		
Printing, engraving, publishing and office supplies	$ 338.05	
Rent, telephone and postage	484.75	
Expenses board members account meeting	82.85	
Services inspector at large	592.50	
Special inspection	28.40	
Orchard inspection, labor, hand-picking and spraying	2,093.23	
Express and telegrams	29.75	
Spraying supplies, spraying machines, freight, repairing and drayage	778.76	
Balance unexpended and available for 1908	186.31	
Totals	$ 4,614.60	$ 4,614.60

RECEIPTS AND DISBURSEMENTS "APPROPRIATION FUND" FOR FISCAL YEAR ENDING NOV. 30, 1908.

Receipts.

Unexpended balance from 1907		$ 186.31
Appropriation for 1908 available to March 1, 1909		4,000.00
Spraying collections		433.22
Remittances to State treasurer		1,085.50

Disbursements.

General Expenses:		
Publishing, printing electrotyes and office suplies	$ 511.25	
Office rent, telephone and postage	488.77	
Rent storing spraying machinery, tools, etc., at Missoula	22.80	
Expenses board members for general and special meeting	294.10	
Orchard inspection and spraying	2,061.80	
Services inspector at large	53.50	
Expert services	54.20	
Publishing Proceedings State Horticultural Society 1907	300.00	
Spraying and machinery supplies, repairing, freight, two spraying machines, and building material	1,724.70	
Express and telegrams	38.56	
Balance	155.35	
Total	$ 5,705.03	$ 5,705.03

RECEIPTS AND DISBURSEMENTS "FEE FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1907.

Receipts.

Fruit trees	$ 5,130.05	
Nursery stock, fumigation and spraying	1,115.74	
Licenses	500.00	
Inspector's excess of fees remitted	216.16	
County treasurer spraying fees remitted	481.65	

Disbursements.

Fees to inspectors		$ 6,245.79
Remittances to state treasurer		1,148.21
Balance		49.60
Total	$ 7,443.60	$ 7,443.60

RECEIPTS AND DISBURSEMENTS "FEE FUND" FOR FISCAL YEAR ENDING NOVEMBER 30, 1908.

Receipts.

To balance from last fiscal year 1907	$ 49.60	
Fruit fees	5,440.76	
Nursery stock and fumigation	808.20	
Licenses	575.00	
Inspector's excess of fees remitted	334.73	
Spraying fees and county treasurer spraying tax remittance	290.73	
Refund overcharge on freight on sprayer to Fromberg	1.00	

Disbursements.

Fees to inspectors		$ 6,458.72
Remittances to state treasurer		985.11
*Balance		56.19
Totals	$ 7,500.02	$ 7,500.02

*The balance of $56.19 was remitted to the state treasurer on November 29, 1908, but did not reach his office in time to be credited to the Board of Horticulture at the close of the fiscal year.

FRUITS INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1907.

Apples	154,134
Pears	20,124
Peaches	65,157
Plums and Prunes	41,815
Cherries	14,226

Apricots	2,890
Quinces	22
Oranges and Tangarines	57,994
Lemons and Grape Fruit	17,395
Grapes	57,834
Strawberries	28,051
Blackberries	4,872
Raspberries	9,396
Dewberries	554
Blueberries	611
Currants	554
Gooseberries	807
Total packages	476,436

Of this amount there was inspected in Butte 309 cars containing 227,116 packages, and in addition 42,902 packages of local freight and express shipments. 573 cars were inspected in the entire State.

FRUITS INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1908.

Apples	187,861
Pears	18,485
Peaches	90,296
Plums and Prunes	41,753
Cherries	20,028
Apricots	4,454
Quinces	595
Oranges and Tangerines	71,949
Lemons and Grape Fruit	15,768
Grapes	134,308
Strawberries	28,055
Blackberries	3,869
Raspberries	11,372
Dewberries	1,166
Blueberries	102
Currants	1,010
Gooseberries	928
Total	631,999

Of this amount there was inspected in Butte 274 1-2 cars, containing 95,783 packages, and in addition 144,540 packages of local freight and express shipments. 728 1-2 cars were inspected in the entire State.

FRUIT CONDEMNED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1907.

Apples and Pears (for Codling Moth, San Jose, Scurfy Bark Louse and Oyster Shell Bark Louse Scale)	1,077
Peaches (for Gummosis and Twig Borer)	433
Total boxes	1,510

FRUIT CONDEMNED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1908.

Apples (for Coddling Moth, San Jose and Oyster Shell Scale)	1,439
Pears (same as for apple)	11
Peaches (for Gummosis and Twig Borer and Peach Scab)	374
Apple Scab	10
Oranges (Purple Scale)	384
Apricots (Shot Hole Fungus)	82
Total	2,300

FRUIT TREES, PLANTS, ETC., SHIPPED INTO MONTANA AND INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1907.

Apple and Crab Apple trees	123,074	
Apple Seedlings	198,853	
Pears	6,289	
Peaches	1,356	
Plums and Prunes	13,466	
Cherries	18,052	
Apricots	192	
Quinces	126	361,408
Shade Trees	66,540	
Ornamentals, Shrubs and Bulbs	21,439	87,979
Evergreens	27,716	
Roses	6,663	34,379
Black and Dewberries	15,591	
Raspberries	20,859	
Mulberries	621	
Currants	21,899	
Gooseberries	15,465	
Strawberries	101,435	
Grapes	6,004	
Buffaloberry	315	
High Bush Cranberry	125	182,314
Total		666,080

FRUIT TREES, PLANTS, ETC., SHIPPED INTO MONTANA AND INSPECTED IN THE STATE FOR THE YEAR ENDING NOVEMBER 30, 1908.

Root Grafts	149,500	
French Apple Stock	900	
Apple Seedlings	65,410	
Apple and Crab Apple	177,602	
Pears	7,012	
Peaches	3,469	
Plums and Prunes	22,692	
Cherries	19,578	
Apricots	220	
Quinces	117—	446,500
Shade Trees	78,961	
Oranmentals, Shrubs and Bulbs, Evergreens, Roses	50,520—	129,481
Black and Dewberries	9,027	
Raspberries	34,118	
Mulberries	534	
Currants	11,618	
Gooseberries	11,437	
Strawberries	379,919	
Grapes	3,570	
Buffaloberry	156	
High Bush Cranberry	241	
Rhubarb and Asparagus	13,389—	464,009
Total		1,039,990

NURSERIES INSPECTED FOR THE YEARS ENDING NOVEMBER 30, 1907 AND 1908.

Number of acres	190
Number of Small Plants	185,000
Number of Trees	782,000

No trees or small plants condemned for disease or pest. All nurseries reported in good condition.

DRY LAND FRUIT CULTURE.

By Hon. Fred Whiteside, Kalispell, Montana.

As there are vast areas of land in Montana that can never be irrigated, the production of profitable crops on these lands is one of the important problems in the developemnt of the state. In dry land farming, success depends largely upon the amount of moisture that can be retained in the land by proper handling of the soil, and this in turn is influenced in no small degree by the nature of the crop being produced. As the chief element in dry land work is constant and thorough cultivation, the crop which most readily permits the cultivation is the one most advtantageous for dry farming. And in this connection it may be said that no other crop will permit of as easy and thorough cultivation as the orchard.

While the orchard is non-productive for the first few years the land between the trees can be used for growing potatoes or other crops that can be cultivated, but this is not advisable. except where the annual precipitation is considerable. Every plant grown on the land, whether it be potatoes, weeds or oher vegetation, robs the soil of a portion of the moisture stored therein, and consequently clean cultivation without any crop in the orchard is by far the best method, but it is far better to grow a well cultivated crop in the orchard than to allow it to grow up with weeds. It is also of the utmost importance that the work of cultivation be started early in the spring. In fact, it should be started just as soon as the snow is gone and the land is dry enough to work. As the chief object of cultivation is to prevent evaporation of moisture it follows that cultivation should begin before the moisture has evaporated. Cultivation will be of but little benefit if it only begins after the dry winds have blown over the land for three or four weeks. To use an old expression, "it is useless to lock the stable after the horse has been stolen." The orchard should be cultivated as soon as possible after every rain, especially if the top of the soil has been packed by the rain, for in this condition it loses moisture rapidly. But never stir the soil if it is wet enough to stick.

The amount of cultivation necessary to give the best results can hardly be stated in a hard and fast rule, but generally speaking, if enough cultivation is given to keep the orchard entirely free from weeds the trees will thrive. This rule, however, does not apply to new land for such land produces but few

weeds. While no rule fixing the proper amount of cultivation can be laid down, owing to the differences in soil and other conditions, in my own experience I have found it best to cultivate the orchard three or four times each month during the entire growing season. If no other crop is grown in the orchard the work is much simplified, as cross cultivation can then be practiced, which saves much hard labor in keeping the weeds out.

The best tool to be used in cultivating the orchard is the spring tooth cultivator. It is five feet wide, made in two sections, eight teeth in each section. By using a long bar the two sections can be spread apart, making the machine 10 feet wide. In this form a strip of land five feet wide is left between the two sections without cultivation. This permits cultivation of the land near the trees without driving the team very close to the trees and after going over the orchard in this manner the cultivator sections can be put together and the strips of land not cultivated the first time over can be cultivated.

Deep cultivation of the orchard is not necessary but it should not be less than four or five inches in depth. The effect of this cultivation is three fold. It puts the plant food contained in the soil in condition to be assimilated by the roots. The loose earth acts as a mulch to prevent evaporation of moisture and when the rain falls it acts as a sponge to hold the water until it can soak into the subsoil, for if the surface of the land is hard the water will run off before it can be absorbed into the soil. The subsoil acts as a reservoir to hold the water which falls upon the land and unless the surface of the land is kept loose and mellow by cultivation the water stored in the subsoil is brought to the surface by capillary attraction and is lost by evaporation. As it requires about 500 pounds of water to grow one pound of vegetation (dry) it is apparent that a very light crop of weeds will rob the soil of an enormous quantity of water which can be saved by clean cultivation for the production of the crop.

Fruit growing in the west has recently attracted wide attention because of the high prices commanded by fruit lands and the enormous profits made by growers.

Unplanted lands suitable for fruit growing in the intermountain region of the west are selling in many places at $500 or more per acre while good orchards already in bearing can hardly be purchased at any price. This is not hard to understand because growers in many instances have received more than $1,000

per acre in net returns from a single crop. Apple trees are set about 100 to the acre and usually begin bearing about the third year. The fifth year after planting the yield is usually about one box per tree and the yield should increase about one box annually per tree thereafter. Four hundred Wealthy apple trees planted in my own orchard, near Kalispell, in 1898, yielded 3,000 boxes of apples in 1907. From 800 apple trees of the McIntosh Red variety planted in the same orchard in 1901, 1,500 boxes of apples were picked in 1907, and at this time (May 15, 1908), the trees are loaded with blossoms for a much larger crop this year.

This orchard has never been irrigated, clean cultivation being practiced.

VARIETIES.

The question which concerns every apple grower most is, "What varieties shall I plant?" This question must be answered differently in almost every section. For often a difference of only a few miles in location makes a wonderful difference in the varieties that can be successfully grown. There are, however, a few varieties that can be successfully grown in almost every section of Montana, and these will be first considered, although most of them. strictly speaking, are not perfect commercial apples. Most of the apples that can be grown successfully over a wide area of the state belong to the early or fall varieties, and the fact that they are not long keepers makes them unprofitable to the large commercial grower, but for the small grower, conveniently located with respect to market, they are usually very profitable. In this class are the Red June, Yellow Transparent, Duchess of Oldenburg and Red Astrachan. Of these four, the last named is perhaps the least desirable, while the Red June is one of the best. It is fine in quality, and being a dark red all over does not spot or discolor from bruises. It is not quite as large as the other varieties named, and like the Yellow Transparent, needs severe thinning. A most serious objection to the Rellow Transparent is its tendency to spot under the slightest bruise, and this objection also holds in less degree against the Duchess, and, in fact, against all yellow apples. Other early apples grown successfully in places, but not yet widely distributed, are the Gravenstein and Benoni. While the foregoing are called early apples, the date of ripening varies greatly with locality and altitude. Other apples grown successfully in almost

every portion of the state are the Snow, Alexander, Wealthy, McMahon White and McIntosh Red. These ripen very close together in point of time and in some places the last four are called fall apples; in other sections they are late fall or early winter apples. As a rule apples ripen later and keep longer east of the Rocky Mountains than do the same varieties west of the

FIG. 1. 9 YEAR OLD WEALTHY APPLE TREE.
(400 trees produced 3000 boxes of apples in 1907.)

mountains, and in this respect the Flathead Valley is somewhat later than points south on the same side of the range.

The Alexander is one of the best fall apples grown in Montana. It is very large, of fine appearance, color red and yellow, and of fair quality. The Snow is of about the same season as the Alexander, much smaller, but of very fine quality, red in color with some green. The Wealthy is perhaps the most widely distributed apple in the northwest and in many respects is one of the best. In localities where it ripens late it may be classed as a good commercial apple, but where it ripens early it is not so good because it does not keep as well. Where it ripens early it is inclined to fall from the tree and begins to wither in two or three weeks after picking, even in the best of cellars. Its color is red with some green, quality fair, size good. The McMahon White is of about the same season, size and keeping qualities as the Healthy and is fine for cooking. All things considered, the McIntosh Red is perhaps the best commercial apple widely grown in Montana. While in a few sections the tree has not been considered entirely hardy, yet losses from winter injury have not occurred in the coldest sections where the trees are grown, and such losses have probably been due to local conditions. The apple is of the finest quality and has a spicy flavor peculiar to itself. It is of good size, dark red in color and keeps until January first, although like other apples, its keeping qualities vary with the date of ripening in different sections. The tree is of good shape and a very vigorous grower.

Of the varieties mentioned the Yellow Transparent and Wealthy are the most prolific bearers, with the Red June a close second. The others are good bearers but cannot be depended upon to produce a full crop every year. The reason for light crops, however, is usually to be found in a lack of cultivation, pruning, thinning or other necessary work.

Apples should be thinned to one in a place, and these not closer than five inches apart on the limb. To accomplish this, it is often necessary to remove four-fifths of the crop, but measured in pounds the matured crop will be fully as large as if no thinning had been done, and instead of small second-class apples the product will be large, first-class apples. Thinning should be done as soon as possible after the apples are formed. Fruit growers often complain about the excessive labor and cost of thinning, but it requires no more time or labor to take the extra

FIG. 2. 6 YEAR OLD RED McINTOSH ORCHARD.
(800 trees produced 1500 boxes of apples in 1907.)

fruit off in the spring than to pick the small apples in the fall.

CRAB APPLES.

When grown on a commercial scale, one of the most profitable fruits in Montana is the crab apple. When produced in less than car lots, however, the grower must depend upon local demand, which is usually unsatisfactory.

Crabs can be grown successfully in every section of Montana and the risk from winter losses is very slight.

For market the best variety is undoubtedly the Transcendent, and for this variety in car lots the demand is almost without limit, the price usually being from $1.00 to $1.25 per box f. o. b. Montana points. Other varieties grown are the Hyslop, Martha, Gibbs Golden, North Star, General Grant and Whitney No. 20, the last named being as large as the ordinary small apple, and is delicious for eating out of hand, but is very short lived. None of the crabs, however, are long keepers.

PLUMS.

Plums are grown successfully all over Montana, but some varieties can only be grown in favored places.

From the standpoint of profit, plums are perhaps the most unsatisfactory of all the fruits grown in the state. This is not due to any lack of quality of productiveness, but to the poor methods of packing, inadequate transportation facilities and the perishable nature of the fruit.

The Bradshaw, Moore's Arctic and DeSoto are among the hardiest varieties grown. The Wyant and Forest Garden are reported from the Experiment Station at Bozeman as being very hardy.

Other varieties successfully grown in more favored places are the Lombard, Yellow Egg, Green Gage, Peach Plum, Tragedy, Pond's Seedling, Italian Prunes and German Prunes.

CHERRIES.

All things considered, cherries are among the most profitable and satisfactory fruits grown in Montana. While the trees are not as hardy nor as long lived as the apple or crab, the hardy varieties can be grown in most sections, and west of the main range the cherry is a standard crop. The demand for the fruit is almost unlimited, and the price received by the grower is from eight to ten cents per pound.

Sweet cherries are produced very successfully in certain sections of the Bitter Root and Flathead, but cannot be grown in all sections, as the trees are not entirely hardy, and even where the trees grow do not always fruit well, but where the sweet cherry can be grown it is highly profitable. Of the sweet cherries the Bing and the Royal Ann is equally large, but lighter in color. The Lambert is also grown successfully in places.

The sour varieties of cherries are much more widely grown than the sweet cherries, and are prolific and regular bearers. Of these the Early Richmond, Vladimir and Ostheime are perhaps the most hardy, with the Montmorency, English Morello and Wrag close up in point of hardiness. Of all the sour cherries the Montmorency is probably the favorite, being a little larger than the early Richmond and not as sour as the others.

The Wrag, English Morello and Ostheime are dark red in color and are splendid for making wine.

BEST AGE TO PLANT.

In orchard planting most growers of experience prefer trees not more than two years old from the nursery, and many orchardists plant yearlings with very satisfactory results. The

future growth of a tree is retarded by transplanting in proportion to its age, and if trees from one to four years old are planted at the same time, in the same soil, and are given the same care, in a few years the younger trees will be larger than the older ones. For this reason young trees are preferred for planting.

PRUNING.

When the tree is planted, the top is generally cut back to make it balance its root, as the roots are cut severely in digging the tree. The best practice, however, is to reduce the top by cutting out the superfluous limbs. This will give the tree proper shape and will force the growth into limbs that are to form the permanent top of the tree. There is much difference of opinion as to the proper shape for a tree, and particularly the apple tree. The growers of most experience, however, have no fixed rule for shaping or pruning the tree, each tree being treated according to its requirements. If a tree is a very upright grower the inside branches are cut out to make it more spreading. If it is very wide and spreading the outside branches are cut off to make it more upright. The ideal form which most growers endeavor to reach is an urn shaped tree with the trunk dividing into three or four main branches about two or two and one-half feet above the ground, these three or four branches forming the entire top of the tree. The main branches should start out at nearly right angles to the trunk, and curve upward, which will obviate the danger of the tree splitting down. This danger is further provided against by twining together two of the small inside branches from opposite sides of the tree. These will grow together and form a solid tie across the tree, and if the tree has four main branches there should be two of these ties fastening the opposite main branches together. A tree that is properly shaped when planted will require no pruning, except to keep the suckers and small limbs trimmed out, and this should be done at least once a year. Winter or early spring is the best season to prune, as the trees are then bare of foliage; but most growers prefer to avoid pruning when the wood is frozen. If a tree is planted with a large number of branches, these must be cut out from year to year, and much of the energy exerted in growing wood is thus wasted.

THINNING.

One of the problems that has claimed the attention of fruit growers for many years has been the disposition of second class

apples; but this problem has recently been solved by growers of the Pacific Slope by thinning the fruit until there are no second class apples produced, practically all of the apples produced being first class, and this really is the only correct solution of the problem. By severe thinning and rigid rules for packing, these western growers have brought the price of Spitzenberg and Newton Pippin apples from about $1.00 per box up to $2.60 per box, the entire crop being sold by the carload through the Fruit Growers' Union. The same thing can be done in Montana, but the work must start at the bottom. First, the worthless varieies of apples must be changed by top-grafting into desirable sorts suited to the locality where grown, and then by proper cultivation, pruning, irrigation, thinning and packing the Montana grower can get the highest price paid in the world for apples, for when the proper varieties are grown under proper conditions the Montana apples are excelled by none.

APPLE BOXES.

Montana growers have long endeavored to secure a box for apples that will suit all growers, and frequent changes have been made in the size of the standard box. This effort to adopt a box that will prove satisfactory to everybody is futile, because apples of different size and shape cannot be packed to advantage in the same size box, and the man who grows Alexander apples does not want the same shaped box as the man who grows Jonathan or Spitzenberg. It would seem more reasonable to fix the standard cubic contents of the box and allow certain variations in shape to suit the apples to be packed. This would result in a long, narrow box for small varieties and a wide, short box for the large ones.

TOP GRAFTING.

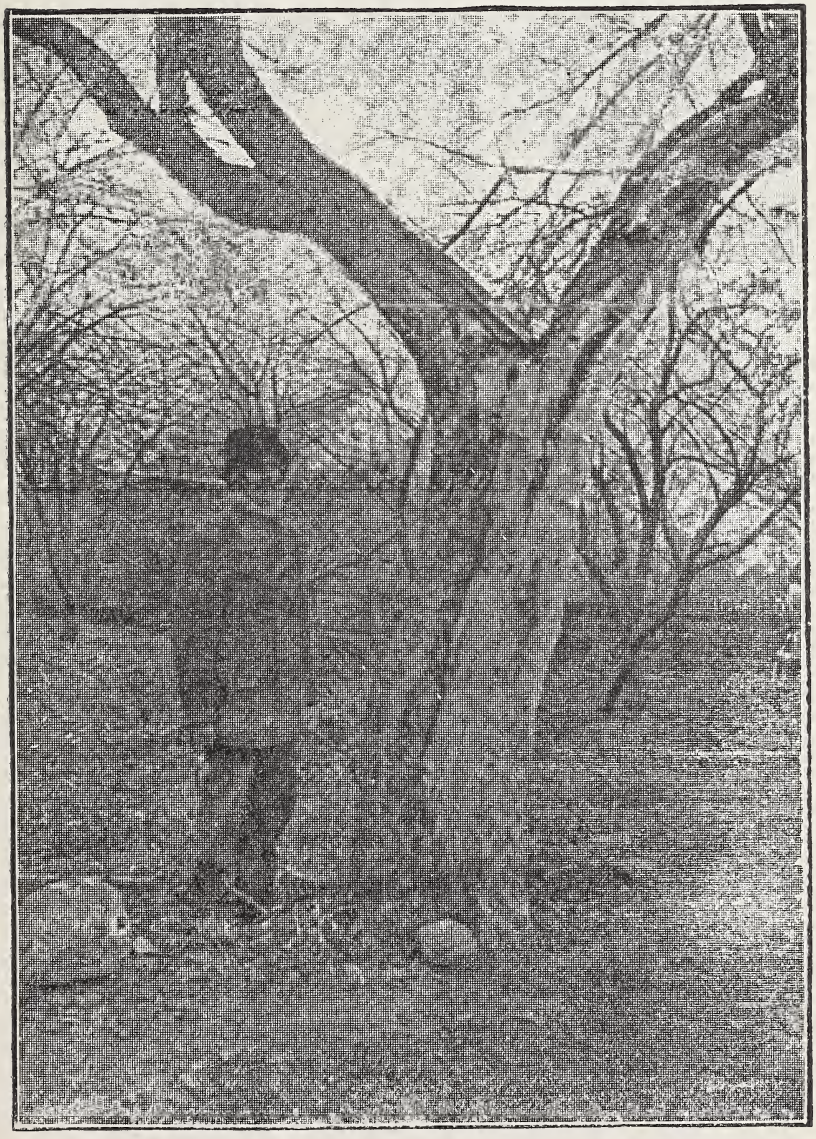
Where an orchard contains varieties unsuited to the locality —and there are many such in Montana—the only remedy is to change the variety by top grafting. To change a large orchard in this manner appears to be a difficult task, but it is not as difficult as it appears. The best season for top grafting is just after the first strong flow of sap has started in the spring, which is usually in May, and top grafting can easily be done successfully during this entire month. The scions are cut during the winter, only the growth of the last season being taken, and these are packed in damp sawdust or sand in a cool cellar until used.

In cutting the tree to be grafted, about two-thirds of the top is cut away. The tree is cut thus severely in order to force the growth into the grafts. It is best to cut the limbs as near the trunk as possible without cutting limbs that are too large. Avoid cutting limbs that are more than one and one-half inches in diameter, if possible.

Both the split graft and the bark graft have been used extensively in Montana, and in an orchard in Flathead County, where 3,000 trees were top worked in 1900, both methods were tested quite thoroughly and where the work was well done, the bark graft gave much the best results.

In this work the wax was put on hot with a small brush. The wax was melted and put in a five-pound lard pail, which was suspended inside of a ten-pound lard pail, in the bottom of which had been placed a small alcohol lamp, the heat from the lamp keeping the wax at the proper temperature. The wax was composed of five parts resin and one part tallow, by weight, no beeswax or other ingredients being used. This wax is very cheap and will not melt or run under the hottest sun. The trees were cut two or three weeks ahead of the grafting. The scions were put in by a man, the wax being put on by a boy, and the bark grafts were wrapped with a strip of waxed cloth, about half an inch wide, to hold the scion in place and prevent warping of the bark. This work was also done by a boy. The total cost of grafting eight and ten-year-old trees was eight cents per tree. The remainder of old tops will be cut out next spring, and where needed additional grafts will be put in. This will cost about five cents per tree additional. Where possible, it is best to leave about a six-inch stub in cutting limbs, in order that a second graft may be put in if the first one dies. This is done the following season, first cutting off the old stub.

THE McINTOSH RED APPLE—HISTORY, ETC.



From a photograph owned by Mr. G. A. Blair, Victor, Montana.

The original McIntosh tree is 118 years old and is located on the McIntosh farm at Dundela, Ontario, about 40 miles from Ottawa, Canada.

Fourteen years ago the tree was seriously injured by the burning of a building which stood near it; the scars of the fire

are visible. However, one-half of the old tree continues to bear the red apples which are famous in portions of Montana, particularly in the Bitter Root Valley. It has been bearing continuously for more than a century.

Dundela McIntosh was the discoverer of the tree. It is interesting to note that the McIntosh Red was originally a chance seedling. The story that is told on the McIntosh farm is that the original Dundela McIntosh, in clearing brush that had grown up about his cabin, came upon 14 apple sprouts that had come up from chance scattered seed. These he allowed to grow. Of them all, only the one which is the parent of all the McIntosh Red trees amounted to anything. But that one was enough.

Mr. Blair of Victor, Montana, has a photograph of the tree and about a few years ago visited the McIntosh farm at Dundela and saw the tree.

The old tree is undoubtedly the oldest and hardiest bearing apple tree in the world.

"The McIntosh and Alexander apples can be grown to perfection in Montana, better than any place in the world. The Jonathan and Maiden Blush grow to perfection in the Clearwater Valley of Idaho, and the Spitzenberg and Newton Pippin excell when grown in the Hood River Valley of Oregon. These varieties, when grown in Montana, do not compare favorably with the Idaho or Oregon products. Then why attempt to compete with Oregon, Washington and Idaho, with the same varieties, when we can grow the McIntosh and Alexander better than can be grown elsewhere?"

HOW BEST TO CONTROL AND ERADICATE INSECT ENEMIES AND PESTS.

Insects are of two distinct classes. Some are the biting (mandibulate), others are of the sucking (haustellate) kind, each group involving a special system of treatment.

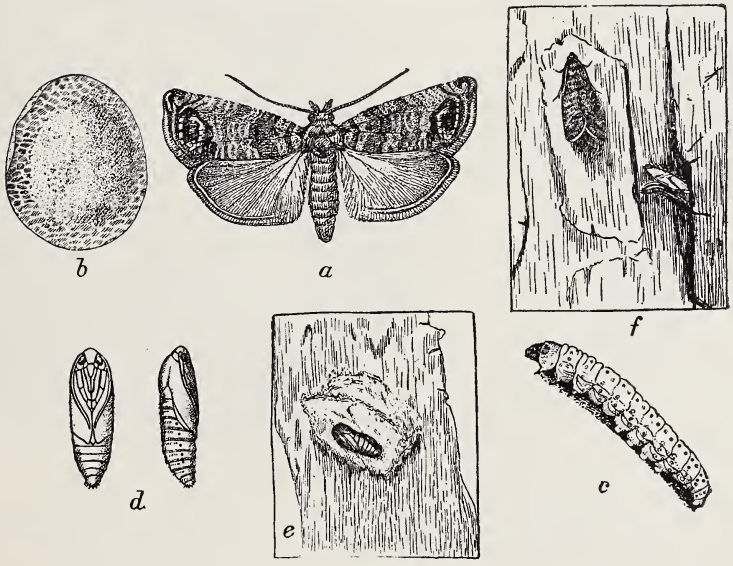
For the biting insects, such as the Codling Moth, Tent Caterpillar, Cut Worms, etc., a spray that deposits a poison upon the fruit or plant on which the insect feeds is used, such as Paris Green or any of the Arsenate of Lead solutions. Of these the most effective is Disparene, an Arsenate of Lead preparation made by the Bowker Insecticide Company of Boston and the James A. Blanchard Co., New York, N. Y.

For the insects, such as the Aphis, Red Spider, Oyster Shell Bark Louse, etc., which live by sucking the juices of the plant

or fruit, a spray must be used that will kill the insect when it comes in contact with the body, such as Kerosene Emulsion, Lime and Sulphur. Tobacco Decoction or Whale Oil Soap and Quassia Chips.

Fungus diseases come from the growth of parasite plants which use the fruit, trees or fruit plants as host plants. Bordeaux Mixture is the universal remely for these diseases. Copper Carbonate Solution is also used to some extent, and Lime and Sulphur is effective in some cases.

THE CODDLING MOTH OR APPLE WORM.



THE CODLING MOTH.

(a) The moth or adult insect, slightly enlarged; (b) the egg, greatly enlarged; (c) the full-grown larva, slightly enlarged; (d) the pupa, slightly enlarged; (e) the pupa in its cocoon on the inner surface of a piece of bark, reduced about one-half; (f) the moth on bark and empty pupa skin from which it emerged, about natural size. (Simpson, U. S. Dept. Agr.)

This insect, the great cause of wormy apples, is one of the worst foes of the apple grower and one which will thrive in neglected and untreated orchards. Where apple and pear trees are grown, it is only a matter of time until this pest appears, due to the various agencies tending to its distribution. The moth is greyish brown and has transverse streaks of grey and brown on its forewings, and on the inner hind angle a large brown spot like a horse shoe. The hind wings are light brown. It is one of the most destructive to apples and pears. Its destructiveness reaches a fabulous sum throughout the entire country. The climatic

conditions of our state are not as favorable to it as in other states on account of the cool nights. The moths lay their eggs on the blossom, fruit and leaves, which soon hatch, and the larvae eats its way through the calyx end of the apple. However, if the tree is sprayed as soon as the petals have fallen and before the apple has formed and a poison of Disparene, Paris Green or Lime Arsenic is deposited in the calyx end, the larvae is sure to partake of it for its first meal, which means its death. Therefore, it is imperative that the first spraying be done thoroughly, which can be ascertained by examining a number of the calyxes to know whether sufficient poison has been deposited therein or not. If the first spray is thoroughly done it will lessen the second brood, as the Codling Moth is two brooded in Montana. The first eggs are laid about the middle of June. The second brood begins its operations about the 10th to the 15th of August. It is this brood that is injurious to fall and winter varieties of apples.

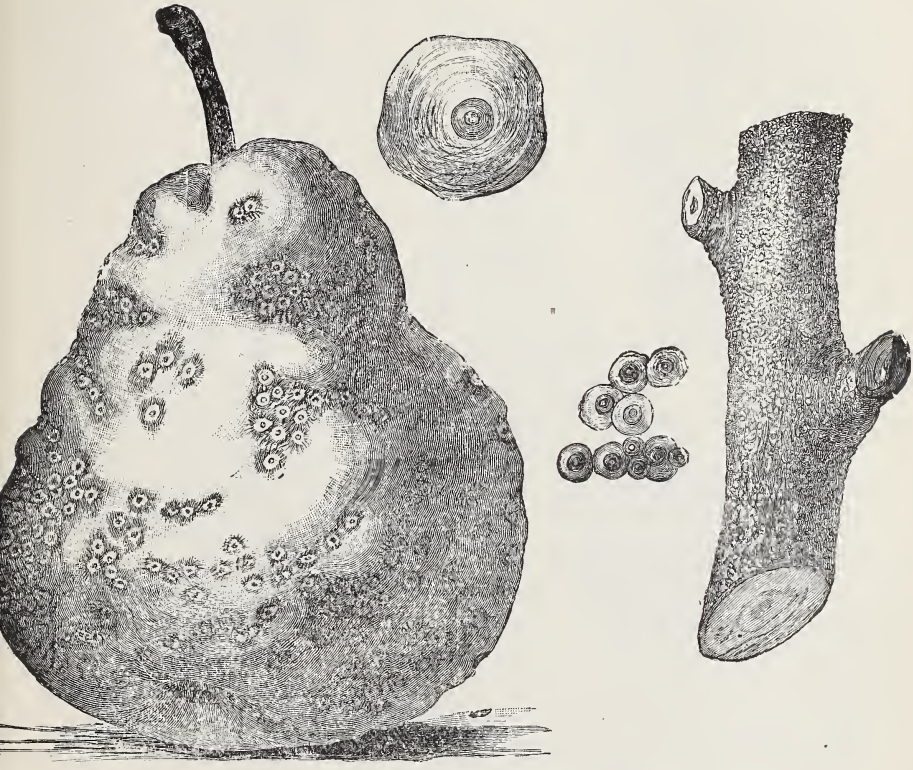
The worms pass the winter in tough cocoons hidden beneath the rough bark of the trunk or larger limbs, in cracks or knot-holes, or under rubbish in the orchard. Where clean cultivation is followed their abiding places are destroyed to a great extent. The first brood of worms go in at the calyx end, while the second brood, about half, go in at the side of the apples. Band the trees a month after blossoming and remove every ten days and destroy all larvae found until August 20th, when it can be left until picking time.

For further information as to spray remedies, for this and other pests, see article on Insecticides and Fungicides which appears on another page.

The State Board of Horticulture of California has been conducting experiments in the propogating of parasites which prey upon the Codling Moth and Oyster Shell Scale.

An effort was made to secure some of these parasites from the California board for introduction into Montana. This effort was unsuccessful. However, the National Department of Agriculture is making an effort for the good of the whole country and will introduce not only one species, but as many as possible. Several hundred cocoons of the Codling Moth preying variety have already been received from different parts of Europe and are being cared for in the insectary of the Department of Agriculture at Washington.

SAN JOSE SCALE.



SAN JOSE SCALE.

A Pear infested by San Jose Scale. Portion of a branch infested by San Jose Scale. Female San Jose Scale—enlarged. Young developing San Jose Scale. (Division of Entomology, U. S. Dept. Agriculture.)

While the San Jose Scale has not yet appeared in the State it is generally spreading in the neighboring states. This pest is of such a serious nature that every effort should be made to keep it out of Montana.

For the information of those who have not seen this insect, it may be described as a small sap-sucking louse, active when first born, but soon becoming immovable on the bark, leaf or fruit, and secreting at this stage a flattened protective scale over its body, losing at the same time its more obvious insect structure and devoting its energies thereafter to feeding on the sap of the plant and producing young in great numbers. In cases where the scale lice are in moderate numbers, they will occur in small colonies or groups, or scattered singly over the bark, presenting then no striking mark to the vision unless one is looking for

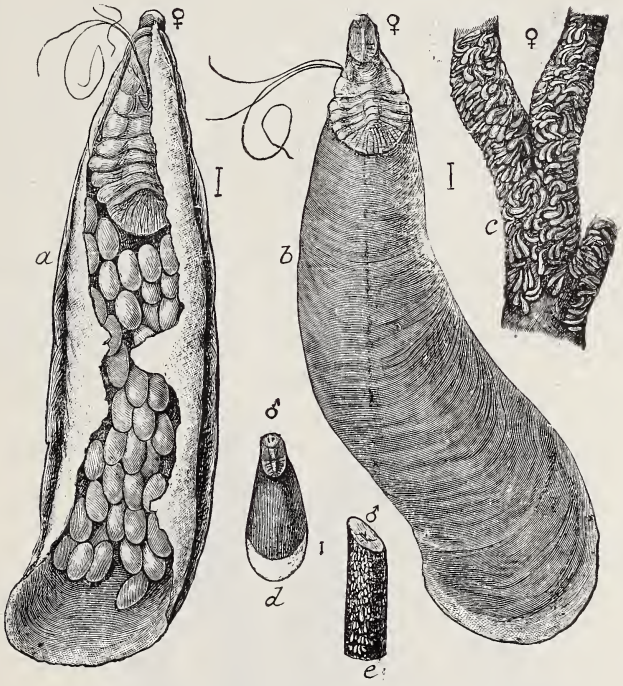
them. When scattered in this manner on younger bark the tissue is generally reddened around them, a feature which lends to their more ready recognition. The adult females are the largest scales, slightly irregular in their convexity, of a dull gray or lighter, with a distinct boss or center of a different color and appearance. Young scales, also abundant at the present season, are smaller, more distinctly circular and of a darker color, often nearly black. All sizes occur together in the clusters, frequently so crowded that the true color of the bark is not visible for the scurfy covering consisting of the numerous insects.

In May the female gives birth to young, and these travel over the tree in search of unoccupied spaces, which they occupy and then begin the secretion of the protecting scale as above. With several indeterminte broods each season, the new growth is covered as fast as made, and the tree is not able to outgrow its enemy. The injury is done by the abstraction of the sap from all parts of the tree by the hundred thousand beaks throughout the entire growing season.

Owing to the form and feeding habits of the scale lice, the effective agents in their destruction are practically limited to various washes and sprays that act as contact poisons or corrosives. Among these are crude petroleum, coal oil, resin washes and combinations of lime, sulphur and salt among others. Several of these are open to the objection that while destructive to the insects they also endanger the tree. Others cannot be relied upon to kill the insects in all stages, necessitating the frequent repetition of treatment. At the present date the leaf and flower buds being expanded, perhaps as satisfactory a treatment as any is the application of a spray of moderately strong kerosene emulsion, previously preparing the trees by pruning off all that can be spared of the branches, to reduce the surface to be operated on. The application of this spray should be several times repeated during the spring and summer. This will not be completely effective, but may serve as a temporary check. It should not need saying that every infested twig and all other parts should be carefully picked up and burned, to prevent the further spread of the pest.

A more satisfactory treatment is the application, in the dormant season of the tree, of a wash or spray of the lime, sulphur and salt mixture, as employed with good effect in eastern orchards.

THE OYSTER SHELL BARK LOUSE.



THE OYSTER SHELL BARK LOUSE.

(a) Showing female scale and eggs from below; (b) female scale seen from above; (c) female scales, natural size; (d) male scale; (e) male scales, natural size. (L. O. Howard, Division of Entomology, U. S. Dept. Agr.)

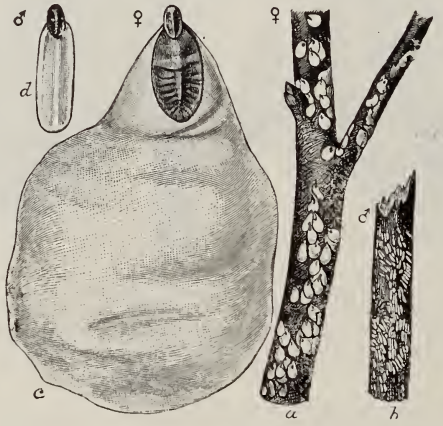
This widely known injurious species is the only scale insect of importance to the fruit grower that has been recognized in Montana. It is found west of the main range or divide, where it has proved to be a troublesome pest and an enemy to apple trees. Where abundant, the sickly condition of the trees are readily observed. It not only incrusts itself on the limbs and twigs, but also on the fruit, and such fruit should be condemned. Several sprays of lime, sulphur and salt will generally suffice to eradicate it. The first spray should be made during the dormant period of the tree during the latter part of March, if the weather is favorable, or in the beginning of April, followed by a second spray, in cases of badly infested trees, before the buds have swollen much. Under each scale from 50 to 90 and in some cases 100 eggs have been found. About June first the larvae hatch out and are able to walk immediately, when they crawl out from under the protected cover of the parent scale to other parts of

the twigs, principally to the young shoots, which at that time of the year are tender and succulent. They then settle down and insert the long thread-like hairs into the bark and suck the juices. It is found on the apple, pear, plum, quince, currant, raspberry and wild cherry. Young trees may be killed in some instances and older ones are much harmed and their vitality retarded. Shade trees often are injured by it. It is found on the rose.

The insect derives its name from its resemblance to a long, rather narrow oyster, which renders it easily to be recognized.

Kerosene emulsion spray or any contact poison spray is also effective if applied just after the young have hatched in June.

THE SCURFY SCALE.



THE SCURFY BARK-LOUSE.

(a) females; (b) males, natural size; (c) female; (d) male; (L. C. Howard, Division of Entomology, U. S. Dept. Agr.)

This scale may be encountered by the inspectors at any time on apples and pears. The secretary of the board has condemned pears infested with this pest. With the San Jose, Oyster Shell Bark Louse and Scurfy Scale we have three of the common orchard scales.

This "Scurfy Scale," or "Harris Louse," is much broader than the Oyster Shell Louse, much paler, almost white in color, and much thinner in texture. The cast larvae skins are at the narrow end of the scale, and in general the life history is like that of the preceding species. The larvae also hatch during the early days of June, and are orange rather than yellow in color. The male scales are comparatively very small and almost snow

white. The eggs are developed in September and are deep purplish brown, varyig from twety to eighty or more, but fewer in number than the Oyster Shell Bark Louse. This scale prefers the pear among orchard trees, and the Keiffer is its favorite variety. Of the shade trees, poplars are most frequently infested, and of the small fruits currants are usual victims. Pear trees are sometimes so badly infected that their trunks seem whitewashed, and in such cases serious injury or death results.

There is only one brood of these scales, and the winter is passed to the egg stage.

Remedy: Lime and sulphur spray applied as for Oyster Shellbark Louse Scale.

WOOLY APHIS.

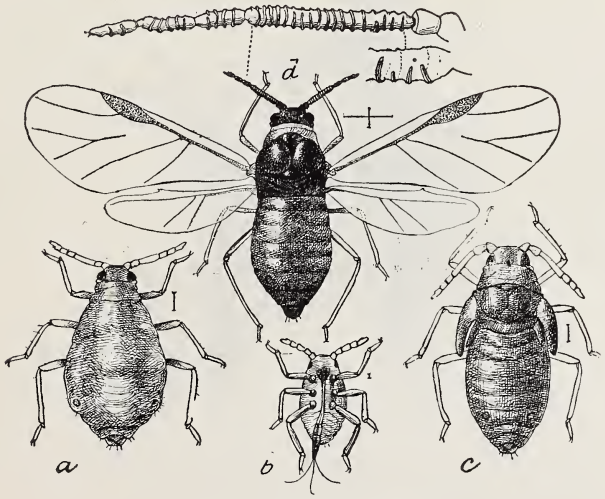


FIG. 1. WOOLY APHIS.

(a) Agamic female; (b) larval louse; (c) pupa; (d) winged female with antenna enlarged above; all greatly enlarged with waxy excretion removed. (Original). (Division of Entomology, U. S. Dept. Agr.)

Appears on the trunk and branches of the apple tree as white wooly patches which show a red color when crushed. Later in the season they migrate to the smaller limbs and twigs.

Another form occurs below the ground, where they form knot-like swellings along the roots.

Both forms are shown in the respective cuts.

Remedies: Spraying with lime sulphur mixture in winter or kerosene emulsion in summer will hold them in check. Pure

kerosene or a strong emulsion driven with force against the patches in early summer will tend to keep them down. For the root infesting form, scraping away the dirt and scattering several pounds of tobacco stems to the tree has been recommended.

APPLE APHIS.

FIG. 2. WOOLY APPLE APHIS.

(a), (b), Work on the roots; (c) enlarged figure of the louse. (U. S. Dept. Agr. Bureau of Entomology.)

Many inquiries have come to this office about this pest, as they are very troublesome and injurious. Young trees, especially in the nursery rows, being more susceptible to its attack than trees in bearing.

The shiny black eggs of this pest may be found during the winter on the terminal twigs and strong growing shoots. They are usually placed around the buds and in the crotches. The lice hatch about the time the leaves start and soon curl them up, and if numerous stunt the growth of the tree. It is very important that prompt treatment be given if you want to rid yourself of this pest. For the lice multiply very rapidly. In the first genera-

tion we have one aphis, which will increase to 10,000 aphids in the third generation. This enormous number should impress you with its importance and the necessity for action.

Remedies: Winter spray with the lime-sulphur mixture will destroy the eggs. When only a few trees are affected, a strong kerosene emulsion may be used, or the eggs may be crushed by the hand. Just after the eggs hatch an ordinary kerosene emulsion will kill the young. Later they curl the leaves so that a spray will not reach them. Spray also with tobacco or whale oil soap and quassia chips.

THE EYE-SPOTTED BUD MOTH.

"Tmetocera ocellana" Schrif.

R. A. COOLEY.
Montana Agricultural College.

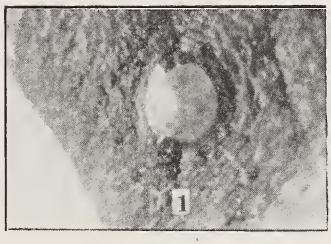


FIG. 1. Egg of the bud-moth, greatly enlarged. (R. A. Cooley, Montana Experiment Station.)

The common name of this insect refers to the characteristic habit of the larvae of feeding in the buds as they expand in the spring of the year. This habit makes the insect an important one, for obviously a very little eating in the young tender buds may cause a great deal of damage. Both the fruit buds and the leaf buds are attacked, the destruction of the former leading to a loss of the crop of fruit, and of the latter to an unnatural and injurious branching of the terminal twigs, particularly in nursery stock. Like many other fruit pests, this insect has its "ups and downs," periods of presence in injurious numbers followed by intervals during which it may be difficult to detect its presence. So far as the writer is informed it has not occurred in injurious numbers in Montana since the spring of 1902. It may, however, become injurious at any time, and fruit growers should be informed regarding its life history and the means of controlling it.

FIG. 3. Full grown larva of the bud-moth, about three times enlarged. (R. A. Cooley, Montana Experiment Station.)

OCCURRENCE IN MONTANA.

The bud moth has been found at widely scattering points west of the main range of the Rockies in Montana and it is believed that it is generally and extensively distributed throughout the apple growing regions in the west end of the State.

It has also been found at Billings.

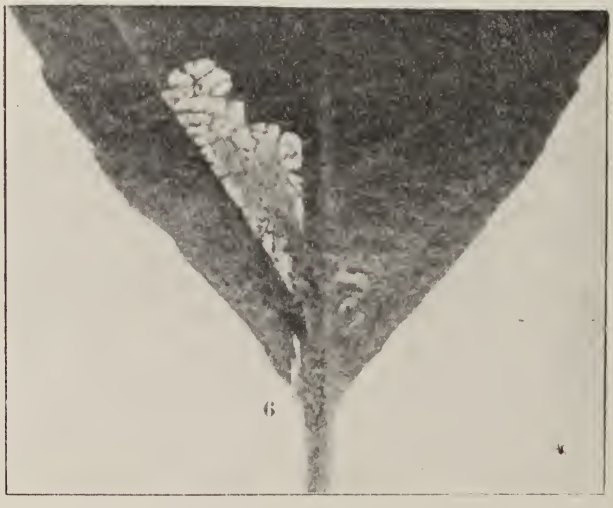


Fig. 2. Base of the apple leaf from below showing work of bud-moth larva. The web and tubular retreat are indistinctly shown. (R. A. Cooley, Montana Experiment Station.)

In spite of the fact that during the years since 1902 this insect has not been destructive, it has continued to spread until now it is much more generally distributed than at that time.

NATURAL HISTORY AND HABITS.

As winter approaches the partly grown larvae of this insect construct for themselves temporary cocoons, or hibernacula. These hibernacula so closely resemble the felty surface of the young twigs as to be very obscure and detected with difficulty even by trained eyes. They are closely secreted in crevices around buds, or on the scars that mark the positions where leaves were attached. They are about one-sixteenth of an inch across and are constructed from the silky secretion produced by the larvae and from the surface parts of the bark of the twigs and thus are made to closely resemble the bark.

In the spring of the year as the buds are swelling, the dark brown larvae with black heads emerge from their winter quarters and go to the buds. As the buds open they crawl in among the tender leaves and flower buds and begin eating. Some perhaps bore into the buds before they expand. As the leaves unfold the larvae makes use of a single leaf and constructs a tubular retreat from which it emerges from time to time to feed. Leaves surrounding the larvae are drawn together and fastened, thus forming a kind of nest. Some dead leaves become detached, but being fastened to the others, fail to drop to the ground, thereby making the nests all the more conspicuous because of the brown leaves among the green. A badly infested tree has a decidedly unnatural appearance.

Mr. Jones, a student assistant, recorded (Second Annual Report Montana State Entomologist, 1904) that after the first molt in the spring the larvae migrate to new quarters, and, crawling into a new cluster of leaves, bind them together into a nest. Some, however, he found to remain in the old nest. Either in the old or the new home, they continue to feed until full size is reached, at which time they measure about a half inch in length. A cocoon is constructed in the old tubular retreat, or in some crack or crevice on the tree, and the larvae transforms to a pupa and later to a moth, reaching this stage about June 20th. The eggs for the new generation are laid in the early part of July and hatch in about eleven days. These eggs are small, flat objects, nearly transparent, and in some respects they resemble the egg of a codling moth, from which they

differ principally in being slightly smaller. By the 20th of July the insect is practically all in the larvae stage again. The newly hatched larvae proceed at once to the underside of the leaves and begin to feed singly along the sides of the midribs, gradually constructing a kind of nest or retreat. For this purpose the leaf pubescence frays and the silk produced by the larvae (are mingled into a tube or covering under which the larvae) remains in hiding when not taking food. Often two leaves are fastened together with the larvae between. It is obvious that it would be impossible to reach the larvae with a spray at this point in the life history unless a poison is applied before the leaves are bound together.

The larvae continues to feed until fall, when they pass to the twigs and construct hibernacula in which to pass the winter. These larvae, up to this point, are small, and the amount of food taken is not large. They are not usually noticed during this part of the year, the food they take being such a small part of the foliage of the tree. There is thus but one brood a year.

Fig. 4. Apple twig showing work done by bud-moth larva early in the season. (After Slingerland, Corne 11 University Experiment Station.)

KINDS OF TREES ATTACKED.

This insect is best known as a pest of the apple, but it also feeds upon the pear, plumb, quince, peach and cherry as well as upon the blackberry among small fruits, in all cases feeding on the buds.

MEANS OF DISTRIBUTION.

From its life history it is clear that this insect has excellent chances of being distributed on nursery stock, since it spends the winter on the twigs. From tree to tree in the same orchard, or over short distances in the same vicinity, the moth can easily fly for the purpose of extending its distribution.

REMEDIES AND PREVENTION.

It is believed that the bud moth will not become troublesome where a program of spraying for the codling moth is carried out, particularly if arsenate of lead is used, though the sprayings for the latter insect are not perfectly timed for the bud moth.

There appears to be three points in the larval life at which the insect is open to attack: First, when the larvae go to the buds in the spring. Second, when they crawl to a new cluster of leaves just after the second molt. Third, when the newly hatched larvae are feeding on the underside of the leaves.

It therefore seems desirable to coat the buds and leaves at these critical points, in cases where no spraying is done for the codling moth. We consider the last two sprayings to be of more importance than the first and it is believed that a single thorough application of arsenate of lead made just before the eggs hatch, thereby coating with poison the leaves that later will be eaten by the young larvae, will in most cases be sufficient remedy in orchards.

On young trees in orchards and nurseries much good can be done by hand picking, taking care not to allow the larvae to escape either from the hand or the vessel in which the nests are being gathered. After gathering the nests should be burned at once.

CURRANT WORM.

CURRANT WORM.

Eggs deposited on under surface of leaves. (b) young larvae; (c) full grown larvae; (d) adult insect.

The most serious insect enemy of the currant in the west is the currant worm. This insect is an unwelcome guest of foreign birth, and in many localities strips the plants annually with the utmost regularity. The eggs are deposited in rows along the veins of the leaves on the under surface, especially on the leaves near the ground, early in the spring. The young begin to feed about the last of May and are frequently well established before being noticed. They reach the upper branches and become conspicuous about the time the fruit is ready to gather, a time when it is more difficult to combat them. If taken in its early stages this insect is easily destroyed with arsenate of lead or paris green of standard formula. These insecticides, however, should not be applied after the fruit begins to color.

At this stage the best material to apply is hellebore.

White hellegore is comonly used on all classes of small fruits as a substitute for paris green after the fruit begins to color. The volatile oil which is its active principal as an insecticide readily evaporates. Hence it becomes harmless a day or two after an application. On account of this fact, however, it is essential to secure a fresh article. Stock carried over from the previous year is worthless, and the difficulty about securing it in a fresh condition is a serious drawback to its use as an insecticide. It may be applied either as a powder or in liquid form. If the latter is used it is a very good plan to mix it with an equal bulk of flour or air-slacked lime, and apply early in the morning while the dew is on or after a shower. In the liquid form it is applied at the ratio of one ounce to three gallons of water.

The cane borer, as its name indicates, is an insect which feeds by boring out the heart of the canes, and in occasional years is very destructive. The eggs of these insects are deposited on the stems in the early summer and a wood grub-like larvae emerges. The larvae burrows into the heart of the cane where it feeds upon the pith and sap wood. In the fall it pupataes and emerges late the following spring as a moth. The canes are seriously weakened by this insect, and injured ones are frequently broken off by strong winds, or when heavily laden with fruit. A careful examination will usually locate a small opening on the side of the cane, thus indicating the presence of the borer. The infested stock should be cut out in the fall and burned.

The currant is occasionally subject to leaf spot and other fungus diseases, and for this reason it is advisable to add Bordeaux mixture to the insecticudes when spraying for the currant worm.

Article and cut by the Fruit Grower Co., St. Joseph, Mo.

PLUM CURCULIO.

"Conotrachelus nenuphar," Host.

The common plum curculio in many instances does as much damage to apples as does the notorious codling moth. This is especially the case with the commercial orchard, where the apples are frequently all reduced from what would otherwise be number ones to numbers two and threes and even culls.

THE PLUM CURCULIO.
Adult magnified five diameters.

The plum curculio is the insect which causes the "sting" in the apple. Fig. 1 shows one of these beetles magnified five diameters.

The insect is so well known that it does not need description, but the life history of the insect in the apple will be given very briefly.

The adult beetles appear during August and begin at once to "sting" the apples by feeding upon them. In doing this they eat small holes through the skin and into the pulp. These holes are usually about one-tenth of an inch in diameter and about the same in depth, and the pulp may be eaten away for a short distance back under the skin. These holes cause the apples to decay at these places and render them unfit for storage purposes. At the approach of cold weather the beetles seek some sheltered place in order to hibernate, getting under rubbish or matted grass, or even entering the ground. In the spring the beetles come out from their hibernating quarters and begin to feed upon the young developing leaves, and later upon the petals of the flowers, and still later upon the young apples. Both the male and female beetles make these feeding punctures in the apples, but later the females also make punctures for the purpose of depositing eggs. In this instance the female eats a hole through the skin and into the pulp, and then turns around and pushes an egg into it. Having accomplished this, she eats a crescent-shaped cut through the skin, partially surrounding and partially undermining the egg. These punctures are made for the purpose of depositing eggs and also the feeding punctures are called "stings" by the horticulturist.

When the apple is comparatively small it tends to outgrow

these "stings" and will usually do so, leaving only a scar, provided fungoid and other diseases do not enter at this point. If the egg hatches and the larvae eats its way into the pulp a short distance and then dies, the apple may recover from this, but will leave a scar situated in a depression. This depression is due to the fact that the tissue where the larva has eaten becomes hard and does not grow to the extent the surrounding tissue does, and if cut into will appear as a short, dark colored, hard thread which is bitter to the taste. In this way the great bulk of our knotty and gnarly apples are produced.

If the apple in which the young larva is feeding falls to the ground the larva will continue to feed upon the pulp, mining in a zigzag direction through it towards the core, and when full grown will leave the apple and enter the ground about two inches in depth, pack the earth away from its body so as to make a small earthen cell, inside of which it will transform to a pupa. If, however, the apples containing the young larvae fail to fall by the time the larvae are half grown, the larvae appear to all perish.

Fortunately, comparatively few eggs deposited in apples ever succeed in hatching, and of those that do hatch into larvae, very few ever succeed in reaching the full grown larval condition.

The larvae requires about three weeks to reach maturity, and the pupa requires a little over two weeks before the adult hatches; but as the larvae usually remains in the ground about ten days before it transforms to a pupa, and as the adult after it hatches usually remains in the ground about ten days before coming out, we find that this insect passes fully as much time in the ground as it does out of it, from the time the egg is deposited until the larvae enter the ground.

As the female bettles that have hibernated over winter begin to deposit their eggs in the young apples about the middle of May, when the apples are about the size of hazelnuts, and as they are a long time in depositing their two hundred and fifty to four hundred eggs, doing so during the latter half of May and all of June and the first half of July, and as the first adult beetles begin to emerge the latter half of July and during all of August, and at once begin to "sting" the apples for feeding purposes, one can readily see that the apples are being "stung" continually throughout the entire season, that the larvae can be found in

them until the fore part of August, and that the pupae will therefore be found in the ground from the fore part of July to the fore part of September. The fact that the first of the young adult beetles begin to emerge and "sting" the apples before the last of the old beetles are through "stinging" them, has led some to suppose there is more than one brood of these beetles each year, but you can readily see from what I have given of their life history that there is but one brood each year. The old beetles die at the approach of cold weather and the young beetles hibernate over winter under rubbish of all kinds, and do not deposit their eggs until the next spring and summer, although they "sting" the fall apples for feeding purposes only.

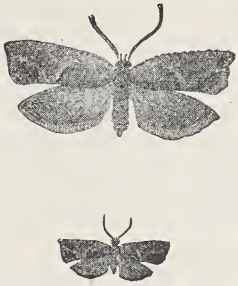
Redemies: It is possible to kill many of the adult beetles in the spring of the year while they are feeding upon the unfolding leaves, provided one sprays thoroughly twice before the blossoms open with any of the arsenical poisons.

It is also possible to kill great numbers of the pupae and of the young adults in the ground before they emerge, provided one will plow the orchard shallow and immediately and thoroughly harrow the same the middle of July and then harrow thoroughly again the first and again the fifteenth of August. The plowing and harrowing breaks the earthen cells in which the pupae are situated and kills the great bulk of them, and the middle of July until the middle of August covers the period in which the pupae are found in the ground.

The best single method, however, of fighting these insects is to take advantage of the fact that the larvae will die by the time they are about half grown unless the apples fall to the ground. Hence, if we will pick up once each week and destroy by burning or by feeding to stock windfalls, or will turn hogs or other stock into the orchard so that they will eat up the apples as fast as they fall, we can thus prevent the development of adults which would come out and reinfest our orchard. It must be understood that the spraying in the spring of the year is the only method that will greatly lessen the number of "stings" in the early apples that particular year. The destruction of windfalls and the cultivation of the orchard lessening the number of "stings" for the next year more especially and also lessening the late "stings." If the above directions be followed one can in a year or two, so rid his orchard of these insects that the "sting" will be practically prevented.

Cut and article by the Fruit Grower Co., St. Joseph, Mo.

ATTACKING THE LEAVES.



STRAWBERRY LEAF-ROLLER.

Adult Strawberry Leaf–Roller. The upper figure enlarged, the lower figure natural size.

The adult of this insect is a small moth about a half inch across its expanded wings. The front wings are reddish brown, streaked and spotted with black and white, while the hind wings are dusky. One of these moths is shown in Fig. 1, natural size and also magnified.

The adult moths appear in the spring and deposit their eggs on the leaves of the strawberry plant; the larvae when hatched feed upon the same, and at once fold the leaves over and fasten them by means of silken threads, thus protecting the larvae, since they do not eat through the outer epidermis. This injures the plants, and where numerous causes the bed to appear as if a fire had passed over it. When the larvae have become full grown they transform to pupae with the folded leaves, and in a couple of weeks transform to adult insects, which immediately pair and lay eggs for another brood.

The pupae of the second brood remain over winter as such. The first brood appears before the strawberries blossom and the second brood after the strawberries have been gathered.

Rmedies: While it is possible to spray the strawberry plants before the fruit is one-half grown with any of the arsenical poisons and kill these insects before they have folded up the leaves and become protected from any spray, nevertheless this is not as successful a method as to wait until the strawberries have been gathered, and then mow the plants and allow thm to dry, then set fire to them when the wind is in a favorable direction and burn over the entire patch. If the plants are not thick enough to burn well by themselves, straw may be spread over to help in this process. This burning of the plants at this time will not injure them in the least, even though it be dry season.

STRAWBERRY WEEVIL.

Is a small black beevil, attacking the buds and blossoms of the strawberry, destroying the stamens of the bi-sexual varieties and ruining them both for fruit and for purposes of pollination.

Remedies: The best poison spray is Arsenic of Lead at the rate of four pounds in 50 gallons of water. To obtain the best results from spraying, the vines should be treated a day or two before blooming, two or three days after the first blooms and again five or six days after that.

Kerosene Emulson or White Hellebore, the plants to be sprayed as soon as the buds are set.

STRAWBERRY ROOT LOUSE.

While this pest has not, as yet, appeared in Montana it is nevertheless one with which we should be acquainted and the Inspectors should be careful in their examinations of strawberry roots, as they are usually introduced from the nursery or from old infected beds.

The lice are found in clusters; very small, blackish, and wingless. When abundant, great numbers of ants' nests will be found in a strawberry bed, which is indicative that root lice are present. The infested plants do not thrive or look good and occasionally some die off; the fruit is small and does not ripen well. By sucking the plant juices they injure the rootlets, which die off. They also attack the leaves, though little injury results therefrom. The eggs of this pest are very small, oval, black, shining and are clustered upon the stems and along the ribs of the green leaves. They bring forth their young alive. Scarcely any difference is perceptible between the young and the mother. They are three brooded and it is this brood that becomes winged and fly to other plants and beds. The winged form is smaller bodied than the wingless type and are, apparently, all black. All forms are carried to the roots by ants.

Remedy: No satisfactory remedy is known. Of the various experiments tried it has been demonstrated that ordinary insecticides are of no avail. Drenching applications of tobacco extract directed into the crown, will destroy many of the lice. Secure clean plants and plant upon clean land, is one of the preventitive measures in one sentence.

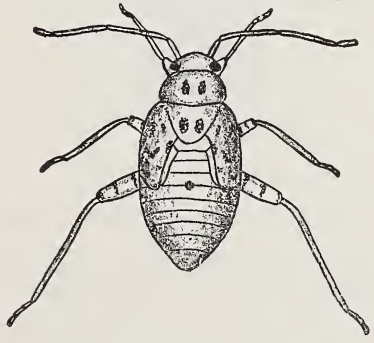
Roots may be cleaned by dipping or fumigating. Dipping in kerosene emulsion or tobacco decoction. Dilute the former with twelve parts of water. Free the plants from dirt and sub-

merge them completely. Keep covered not more than three minutes and then wash well in fresh water.

If well done, this should kill all the lice on the plants. If fumigation is resorted to, which is the easiest, cheapest and quickest way of destroying the pests, the plants should be spread out on trays of wire netting so that the gas can quickly penetrate, and use one ounce of cyanide to 100 cubic feet of space, one and one-half fluid ounces (commercial sulphuric acid and two and one-fourth fluid ounces) of water and allow the plants to remain closed for ten minutes. Be careful not to inhale the gas, as it is one of the most violent poisons known.

ATTACKING THE FRUIT.

Lygus pratensis, Linn.



TARNISHED PLANT BUG.

Fig. 1. Young tarnished plant bug; third stage X 9 diam. (Stedman.)

The tarnished plant bug is a small sucking insect of an elliptical shape, somewhat flattened, about one-fifth of an inch in length and about half as wide. Its color varies considerably, ranging from a dark brown through light brown to yellowish or yellowish green, with darker and lighter markings, which in some instances are more or less obscured. Fig. 2 shows an enlarged drawing of one of these insects, and Fig. 1 an enlarged drawing of the young stage of the insect. The tarnished plant bug hibernates during the winter under rubbish of all kinds, such as is usually found along fences or along the edges of timber or wherever there is any matted grass or weeds. Early in the spring as soon as the buds begin to swell, these insects come out and begin at once to suck the sap from the expanding buds, both leaf and flower, of various fruit trees and bushes, especially the peach. These insects insert their beaks through the tissues of the bud

and extract the sap, introducing involuntarily a little poison which causes the bud to turn dark, and where badly injured may kill the same.

When the flowers appear these insects pierce them as well, and likewise cause them to turn dark and greatly injure them, or kill them if the injury is sufficient. These insects attack not only the orchard fruits, but also the small fruits, such as raspberry, blackberry and especially strawberry, when the blossoms are appearing.

Fig. 2. Adult tarnished plant bug; X 6 diam. (Stedman.)

The tarnished plant bug does its greatest amount of damage, perhaps, in the strawberry patch when the same is in bloom, since wherever these insects suck the sap from the flower or the developing berry it causes that portion to cease growing and may kill it outright or will cause an uneven growth or a complete "buttoning" of the berry. While this is not the only cause of "buttoning" it is usually the principal cause, and it is also the principal cause of the buds, flowers and young fruit "blighting," as it is called.

The tarnished plant bug deposits her egg in the spring singly on the plants upon which it is feeding, and the young bugs hatching from these eggs begin to suck the sap in a manner similar to the adults; so that later in the season these insects may be found in various stages of development on the plant.

Remedies: In the orchard the best plan of fighting these insects is to spray the trees early in the morning while it is yet cool with kerosene emulsion. If one waits till the sun is up well and the atmosphere warm, these insects are so active that they will fly away from the tree before the spray can reach them. In the strawberry patch, however, as these insects are there feeding

upon the flowers and developing berries it is not advisable to use the kerosene emulsion because the same will taint the berries and the emulsion may interfere with pollination. Hence in the strawberry patch one should dust the plants early in the morning with fresh and pure pyrethrum, one pound of which should be mixed with two or three pounds of common flour and the same applied by means of any of the numerous dust applying machines. Pyrethrum can also be sprayed upon the plants by mixing a pound of the pyrethrum with three gallons of warm water.

Another excellent method of fighting these insects is to spray the plants with a patent extract of tobacco known as "rose leaf extract." One gallon of this extract in fifty gallons of water will give excellent results. I have tried making an extract of tobacco, or tobacco tea, myself, but have never been able to reach anything like the good results with it that can be obtained with the patent extract given above.

Cut and article by Fruit Grower Co., St. Joseph, Mo.

CANKER WORMS.

Canker worms (or measuring worms) have not yet appeared in Montana. However, they may be brought in in shipments of strawberries which should be condemned when so infested. They appear soon after the foliage is expanded in the spring. rapidly devouring the foliage or turning it brown. Whole orchards may be seen to be of a brown color at a distance, as a result of the attacks of this insect. When an infested limb is jarred the slender caterpillars, about three-fourths of an inch long, let themselves down by silken threads.

Remedy: Spray propmtly and thoroughly with an arsenical poison as soon as their presence is first detected. In regions where they are suspected to be present it is well to keep the trees banded with building paper smeared with an adhesive substance which may be watched in the spring of the year for the purpose of learning whether or not the wingless moths are ascending the trees to lay their eggs. A large proportion of the damage may be averted by the use of such bands. Tar or printer's ink may be used but are less satisfactory.

APPLE SCAB.

APPLE SCAB.
(Venturia pomi.) (Michigan Agr. Experiment Station.)

Apple scab is perhaps the most destructive fungous enemy of the American fruit grower, particularly in the north, occupying among diseases a position ranking with that of the codling moth among the insect foes of the apple. Its injuries are greater than are generally appreciated, both in effect and extent. The yield of fruit per tree is greatly lessened whenever scab is present: (1) By the premature dropping of young apples, due to the attacks of the scab fungus on flowers, stems and fruits soon after the blossoms fall. (2) By the smaller size of the scabby apples that mature. (3) By the loss, just before picking, due to the fact that scabby fruit does not cling well to the tree and is more easily blown off. (4) The value of the fruit harvested is greatly diminished, since spotted apples must be placed in a lower grade and sold for less than clean fruit. (5) Their keeping quality also is impaired, as molds and other fungi which cause decay gain entrance through the scab spots and increase the loss during storage. Nor is the damage confined to the fruit. The leaves also are scattered by the fungus and the resultant spotting and distortion considerably lessen the vigor and general health of the tree.

The aggregate loss from scab is enormous, amounting to

many millions of dollars every year. This is a most oppressive tax on the farmer, since it is unnecessary. An effective remedy is available in Bordeaux mixture. The experience of many years has demonstrated that the loss from scab may be almost entirely prevented by thorough and timely spraying, which is considered by the leading fruit growers throughout the country to be an indispensable orchard practice.

Apple scab is caused by the summer or conidal stage of a fungus found in its perfect form on dead apple leaves. The disease appears first on the leaves shortly after they unfold, the first infections having come from spores blown by the wind from the dead leaves of the previous season. The olive green, velvety spots on the leaves and fruit produce great numbers of spores, which spread the scab broadcast. In a favorable season the flowers and very young fruit and its pedicels are attacked also. The fungus grows in this manner throughout the summer and autumn. In late autumn and winter the Venturia or perfect stage is produced on the dead apple leaves on the ground.

The relative severity of the disease is influenced by a number of factors, chief of which is the weather. A low temperature and abundant moisture favor the development of the fungus, and consequently scab is worse in cool, damp seasons.

Cultural conditions in the orchard influence the scab fungus as much as they do the codling moth. Neglected, unpruned and uncultivated trees are more subject to scab and careful attention to the general condition of the orchard will always be profitable in connection with spraying.

Varieties of apples differ somewhat in their susceptibility to scab, though not to an extent that will make it worth while to plant resistant varieties with the idea of avoiding the necessity of spraying.

Spray just before the trees are in foliage with the Winter Bordeaux mixture, following with two or three sprays after the blossoms have fallen. The lime and bluestone solutions should be kept separate and used as soon as mixed. If it stands over night after being mixed it may injure the trees if used. It is also dangerous to use it during wet weather. When the apple scab is bad and the season wet, five pounds of the copper sulphate should be used.

See the two formulas given under Fungicides.

PEAR BLIGHT, FIRE BLIGHT AND TWIG BLIGHT.

(Bacillus amylovorus.)

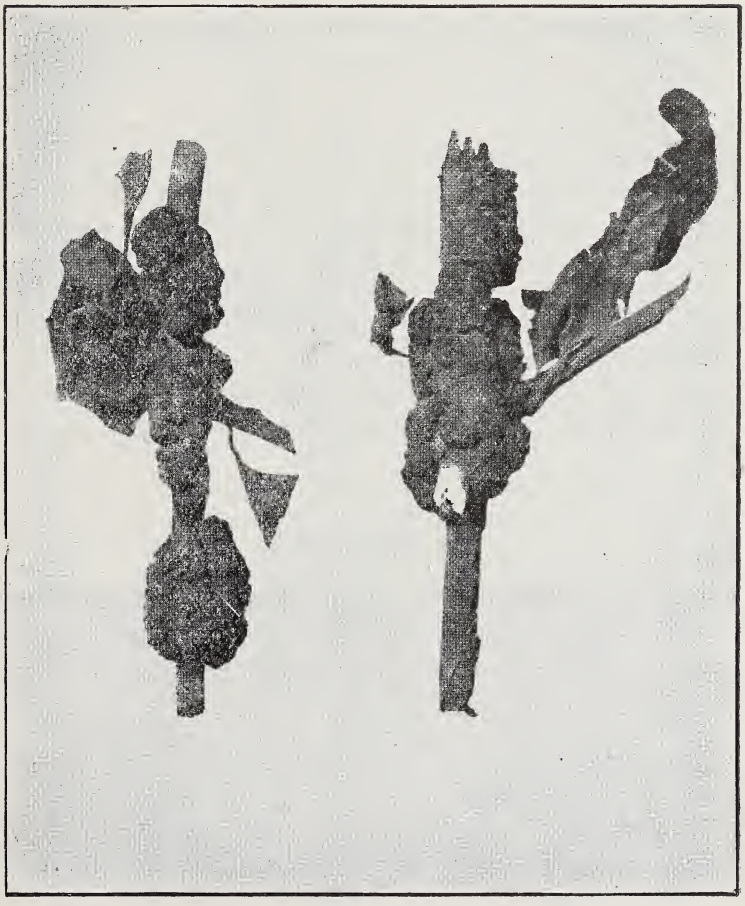
This disease is known to be of bacterial origin. It appears in the spring on the blossoms. Some clusters turn black and the disease is carried from flower to flower by bees or other insects. From the flowers the disease spreads to leaves and twigs. It attacks the tender growth of the apple, pear, apricot, quince, raspberry and blackberry. This disease is exceedingly destructive to pear trees. It appears not regularly, but at times is very destructive to both nursery and orchard trees. Some years comparatively little damage is done, while other years large areas of orchard trees will be destroyed. The only remedy that is known to be of use is the cutting out, a few inches below the blighted portion, all the branches or limbs affected. Refuse trimmings should be burned.

Although many remedies have been suggested for this disease, the only precautionary measure that is now regarded of any value is to avoid fertilizing the trees with stable manures or those rich in nitrogen. Anything that tends to a moderate growth and thorough ripening of the trees is desirable. This disease also attacks blossoms and twigs of the apple and quince trees and spreads in the young growth, killing the terminal twigs.

Department of Agriculture, New York.

BLACK KNOT.

(Plowrightia morbosa.)



BLACK KNOT ON PLUM.
(Maryland Agr. Experiment Station.)

This fungus disease of the plum and cherry if neglected becomes very destructive.

Extensive areas of plum orchards have been entirely destroyed and damage to the Duke and Morello types of cherry trees has been very great.

The first evidence of the presence of the disease is in olive-colored, smooth or velvet like spots on the branches in the spring which extend upon the new growth. These spots develop into rough, irregular knots and become dried and rough by winter.

In the spring the disease is spread by the spores, which

escape in great numbers from the minute cells that form on the olive-colored spots and young knots.

The old knots contain the spores, which live over winter and cause the spread of the disease in the spring.

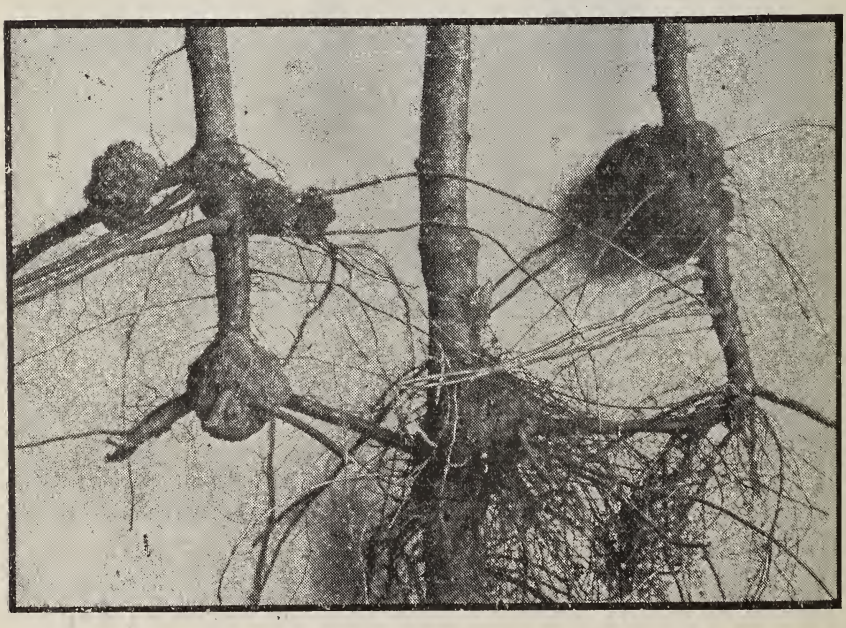
Treatment: As the knots appear early in the growing season they should be removed at once. To control this disease it is necessary to observe its first appearance and cut it out. No knots should be permitted to remain on the tree a day after discovery. Branches bearing knots should be cut off at a point several inches below the swellings or knots and immediately burned, not left lying on the ground.

Wild plum and cherry trees growing in the vicinity of an orchard should be as carefully watched as the orchard itself and all evidences of this disease destroyed.

Spraying with copper preparations, like Bordeaux mixture, may be helpful to prevent black knot, but should not be depended upon.

Department of Agriculture, New York.

CROWN GALL.



CROWN GALL.

Crown Gall has been very injurious to Montana nursery stock and the following article by W. Paddock, Colorado Agricultural

College, is important:

Colorado fruit growers have long known of the destructive nature of crown gall to all kinds of fruit trees. There seems to be some conditions here which make the disease much more destructive than in the humid states. In fact, it has caused so little damage in the east that nurserymen come to regard it as harmless. This probably accounts for the attitude of eastern nurserymen toward our inspection laws. Not a spring passes but some of our inspectors are threatened with damage suits by some nurseryman who has had his stock condemned. Some nurserymen claim not to have heard of the disease before.

About four years ago the United States Department of Agriculture published the results of some experiments with crown gall which apparently proved that it is not harmful to apple trees. While this may be true under the conditions at St. Louis, where the experiments were conducted, every Colorado fruit grower of a few years experience knows that here the reverse is true. Experience has shown our fruit growers that a great many trees die each year from this cause. And it has been noticed in a great many instances that if a badly infected tree is planted it rarely makes much of a growth and it usually dies before it is ten years old.

The cause of the disease has been obscure, though Toomey of Arizona tried to prove that a certain fungus was responsible. No one has ever been able to duplicate his results, consequently it has never been fully accepted. Doctors Smith and Townsend of the Department of Agriculture have recently found that a gall on the Paris Daisy is due to the attacks of a bacterium. They have also found that when peach trees are inoculated with a pure culture of these germs, galls are produced which closely resemble the common crown gall.

It now seems probable that the true nature of crown gall will be discovered; but it is not at all likely that the results will modify our treatment of diseased trees.

In the meantime the inspection of nursery stock should continue to be as rigid as in the past, and it is likely that the interests of all will be best served if all diseased trees are destroyed as soon as discovered.

This latter portion our Montana inspectors should bear well in mind and follow as the law directs.

SPRAYING.

Spraying for fruit pests and fungus diseases is one of the necessities of the progressive fruit grower, as it insures absolutely free fruit when properly and thoroughly done. Spray whether any special cause exists or not, as it acts as a preventive, for once the fungus establishes itself on the fruit nothing will eradicate it and if any pests exists or make their appearance for the first time they will surely partake of it. It also acts as a fertilizer and greatly improves the functions of the leaves. If you wish to secure good prices for your fruit, then spray, for spraying causes perfect fruit to be grown. Good healthy trees, well cared for, are less susceptible to disease than neglected ones, as spraying and pruning go hand in hand. If the orchard is kept clean, as far as possible, the sources of infection are lessened.

Never spray with a poisonous spray while the tree is in bloom, as it results in injury to bees and honey. The bees to a great extent fertilize many blossoms in their search for nectar.

The various spraying formulas are given on another page. Certain kinds of sprays. like disparene, which is an arsenate of lead preparation, can be purchased cheaper than to prepare it yourself and saves you the fear of results, if directors are closely followed. The J. A. Blanchard Co. of New York and the Bowker Insecticide Co. of Boston, Mass., are large manufacturers of all kinds of insecticides and fungicides.

Many people fear danger from poisoning by eating sprayed fruit, but this has been demonstrated to be groundless. No apprehension need to be felt in regard to pasturing cattle or hogs in an orchard with reference to any spray as ordinarly applied.

Spray Calendar.

APPLE.

For first application spray with copper sulfate solution, or better, with strong Bordeaux mixture, before the buds start.

Scab and Rust.

Second application: Give another spraying with Bordeaux mixture as soon as blossoms have fallen. After this two or three sprayings with Bordeaux mixture may be given at intervals of three or four weeks.

Bitter Rot, Black Rot, Sooty Blotch, Fly Speck.

Apply Bordeaux mixture about the middle of July and at intervals of two or three weeks until fruit begins to ripen, then use weak copper sulfate at like intervals.

Add paris green or lead arsenate to Bordeaux mixture for first and second sprayings given under scab. If the insects are numerous give an intermediate spraying with lead arsenate. For

Bud Moth.

Bud Moth and Aphis the following has proven inexpensive and does good work:

Four quarts tobacco solution.
One pound whale oil soap.
Six pounds disparene.
Sixty-five gallons of water.

Codling Moth.

Add paris green or lead arsenate to second spraying with Bordeaux mixture. Give like application after about two months to catch later broods of the insect. It is recommended, for the first spraying given, that a nozzle throwing a rather coarse spray be used, so that larger quantities of the poison will be deposited in the calyx end of the apple, where the caterpillar of this insect usually enters.

Tent Caterpillar, Fall and Spring Canker Worm.

Use paris green or lead arsenate whenever insects show themselves. For very large trees use sticky bands around the stems in spring and fall to prevent the canker worm from crawling up. Destroy egg masses of tent caterpillar in winter and burn or crush the nests in summer.

Fall Web Worm.

Destroy webs as soon as seen and if necessary spray with some stomach poison.

Maggot.

Destroy all infected apples by pasturing hogs or sheep in the orchards. Let chickens have the run of the orchard and they will pick up a large number of the pupae. Carry apples out of the orchard as soon as picked and avoid, if possible, storing them

where flies from the maggots in them can get back into the orchard the following spring.

San Jose Scale. Thorough spraying with lime-sulphur wash in the spring of the year. See article on San Jose Scale.

Scurfy Bark Louse. Spray with whale oil soap, using it at the rate of one pound to seven gallons of water, or with kerosene emulsion.

Oyster Shell Bark Louse. Several sprays of lime-sulphur and salt will generally suffice to eradicate it. Apply in the spring when the young begin to crawl, generally in the latter part of March or about the first of April. Repeat if necessary about June first when the larvae hatch out.

Wooly Aphis. On branches spray as for scurfy bark louse. Cut out the affected parts if possible or wash with pure kerosene. On roots, mix finely ground tobacco dust with the soil around the roots.

Borers—Flat Headed, Round-Headed. Examine trees in spring and fall and dig out, or kill by inserting a flexible wire into the burrow.

BLACKBERRY.

Leaf Spot. Spray with Bordeaux mixture when leaves are half grown. Repeat, if necessary, in two or three weeks.

Rust. Dig out and burn infected plants.

CELERY.

Leaf Spot and Leaf Blight. Spray with Bordeaux mixture in seed bed and every two or three weeks after transplanting until the celery is ready to be blanched. Rotate the celery bed from year to year if the disease becomes very serious.

Worm or Caterpillar. Hand-pick or spray with hellebore.

CHERRY.

Black Knot. Prune away infected branches. Spraying with copper sulfate or normal Boredaux mixture before the leaves come out and later with dilute Bordeaux mixture is a partial preventive.

Shot-Hole Fungus, Leaf Spot. Spray with diluted Bordeaux mixture when leaves are unfolding. Repeat every two or three weeks except when trees are in blossom.

Powdery Mildew. Use potassium sulfid or dilute Bordeaux mixture whenever the disease appears.

Rot. Use Bordeaux mixture when buds begin to open. Repeat when fruit has set. Follow with one or two sprayings of ammo-

niacal copper carbonate, soda Bordeaux mixture or weak copper sulfate solution when the fruit begins to ripen. Pick fruit when dry and just before it is fully ripe.

Aphis or Louse.

Use whale oil soap or kerosene emulsion as soon as insect appears.

CURRANT.

Anthrac Nose and Leaf Spot.

Spray with Bordeaux mixture before the leaves appear. Follow with a like spraying when the leaves are unfolding and every two or three weeks thereafter until fruit begins to ripen. For the leaf spot, one or two sprayings with Bordeaux mixture may be given after the fruit has been picked.

Worm.

Use arsenate of lead in water or in the second or third Bordeaux sprays given above. Hellebore is an efficient poison for this insect and should be used, if it is necessary to use an insecticide, about the beginning of June. Even this poison should not be used later than two weeks before time for picking.

GOOSEBERRY.

Mildew.

Spray with potassium sulfid as soon as leaves begin to appear. Repeat every ten to fourteen days until the end of June or beginning of July.

Gooseberry Fruit Worm.

Destroy infested berries.

PEARS.

Blight.

Cut out infested branches well below the diseased portions and burn.

Leaf Blight, Leaf Spot, Sooty Blotch, Scab.

Treat as for similar diseases in the apple.

Psylla.

Spray with kerosene emulsion as soon as leaves have expanded. Repeat in a week or ten days if necessary.

PLUM.

Black Knot.

See cherry.

Plum Pocket.

This disease is closely related to the leaf-curl in the peach and may be treated in the same way. Diseased fruit should be picked and burned. Spray thoroughly with Bordeaux mixture just before the buds begin to open. If sprayings are to be given later use dilute Bordeaux mixture.

Curculio.

Spray with lead arsenate or paris green and adhesive mixture when fruit begins to form. Jar trees early in the morning while the beetles are sluggish and gather on sheets or in curculio

catchers. This jarring must be done every morning for four
five weeks, commencing when the fruit begins to form.

San Jose Scale. See apple.

Aphis or Louse. See apple.

RASPBERRY.

Anthrac Nose. Cut and destroy badly infected canes in the spring befo
the leaves come out. Spray the rest thoroughly with Bordeau
mixture. Repeat the process after the fruit has been picke
Renew plantation frequently.

Crown Gall. Be careful not to plant infected canes and dig out and d
stroy in the field as soon as found.

Leaf Spot and Rust. Spray with Bordeaux mixture when leaves are half grow
Repeat, if necessary, in two or three weeks. Dig out and bur
rust infected plants.

Cane Borer. Cut out and destroy infected canes whenever found.

BLACKBERRY.

Leaf Spot and Rust. See raspberry.

STRAWBERRY.

Leaf Spot. Spray with Bordeaux mixture before blossoming and agai
after fruit has been picked, or cut the leaves with a mower afte
the fruit has been picked and burn the bed over. Then spray th
new leaves once or twice with Bordeaux mixture during lat
summer and fall. Change bed to new land from time to time.

Crown Borer. Rotation and burning over, as given for leaf spot, will hol
this enemy in check.

POTATO.

Blight. Spray with Bordeaux mixture when plants are five or si
inches high. Repeat every two or three weeks, or as long as i
seems necessaray. Vines should be watched closely in warm
muggy weather following rain, and if not well covered with Bor
deaux mixture they should be sprayed.

Scab. Soak seed tubers for two hours in formalin or corrosive sub
limate solution. Rotate crop so as to avoid planting on infeste
land. The use of barnyard manure, lime or wood ashes favor
the development of scab. Commercial fertilizers should replac
manure as far as possible.

tato Bug. Spray with paris green or arsenate of lead as soon as beetles appear.

P. S.—The foliage of certain varieties of plums is easily injured by spraying compounds, and judgment must be used in their application. In general the "weak Burdeaux mixture" may be safely used as a fungicide and arsenate of lead as an insecticide.

Recent study has shown that the bitter rot fungus causes cankers on limbs of trees. Spores from these canker spots will infect fruit, and they should therefore be cut out, preferably during winter or early spring.

A. F. Stene, Rhode Island Experiment Station.

INSECTICIDES AND FUNGICIDES.

Practically speaking, all insects are divided into two groups, and in order that one may know what remedy to use for any particular insect, the following is given:

Group 1. Includes all biting or leaf insects (mandibulate). For these the following food poisons are given:

PARIS GREEN.

Paris green, one pound.

Quick lime, one pound.

Water, 150 gallons.

Stir the poison into a thin paste with a little water, slake the lime and strain the mixture through a sieve into the vessel holding the required amount of water. Agitation is necessary while operations are going on, as paris green is not very soluble in water and the small granules rapidly sink to the bottom of the vessel.

ARSENATE OF LEAD.

Arsenate of soda, four ounces.

Acetate of lead, 11 ounses.

Water, 100 gallons.

Dissolve the arsenate of soda in two quarts and the acetate of lead in one gallon of warm water.

An especially valuable remedy for spraying very delicate foliage or for use against insects which are killed only by large doses of poison, since it can be used upon plants in much stronger solutions than any other food poisons, without injury to the foliage.

The J. A. Blanchard Co., New York, N. Y., and the Bowker Insecticide Co. of Boston, Mass., offer this and other preparations for sale.

LIME AND WHITE ARSENIC.

White arsenic, one pound.

Lime, two pounds.

Water, two gallons.

Slake the lime and then boil the ingredients together for one hour. For use dilute with 300 gallons of water.

Additional lime in the solution may be necessary to prevent burning of the foliage. Great care is necessary in the preparation of this remedy.

FOR ALL SUCKING INSECTS—CONTACT INSECTICIDES.

Group 2. Comprises all the sucking (haustellate) insects which insert their beaks into the leaf tissues, bark or fruit and suck the juices. For these the following remedies are given:

"Black Leaf" Tobacco extract, a preparation used largely for dipping sheep and cattle. Can be purchased in any of the sheep growing sections of the state at about 90c per gallon retail. It is very convenient and effective in use, one gallon of the "extract" being sufficient to make 60 gallons of spray.

Kerosene oil, two gallons.

Laundry or whale oil soap, one pound.

Water, one gallon.

Dissolve the soap in boiling water and while still hot add the kerosene, taking care to keep the latter away from the fire.

Agitate the mixture violently until it becomes a thick creamy mass. If perfectly made will stand indefinitely without free oil rising to the surface.

This will be found to be efficient for green aphis, wooly aphis, red spider, mealy bugs and certain scale insects.

WHALE OIL SOAP AND QUASSIA CHIPS.

Boil for two hours one pound quassia chips in water.

Dissolve in warm water one pound of whale oil soap. Mix the two solutions and use in six gallons of water.

Most effective spray in summer for use against aphis.

"BLACK LEAF" TOBACCO EXTRACT.

This is also a very good and cheap solution for all kinds of aphis. Use in proportion of one gallon of the extract to 65 gallons of water.

LIME, SULPHUR AND SALT.

Lime, 15 pounds.
Sulphur, 15 pounds.
Salt, 15 pounds.
Water, 50 gallons.

Slake the lime thoroughly, add the sulphur, cover with water and boil briskly for at least an hour. Then add the salt and boil for 15 or 20 minutes longer. Add water to make 50 gallons.

Apply with considerable force through a coarse nozzle while still warm. Experiments show that the salt adds nothing to the efficiency of this spray.

LIME-SULPHUR-CAUSTIC SODA WASH.

Lump lime, 30 pounds.
Sulphur, 15 pounds.
Commercial caustic soda, 4 to 6 pounds.
Water, 50 gallons.
Slake the lime in the resuired vessel.

TOBACCO.

Hard soap (preferably whale oil), 1 pound.
Water, 8 to 10 gallons.
Strong tobacco decoction, 1 gallon.

Dissolve the soap in boiling water, add the tobacco decoction and dilute to 8 to 10 gallons.

FUNGICIDES.

BORDEAUX MIXTURE FOR DORMANT PLANTS.

Bordeaux mixture is perhaps the most generally useful of all spraying compounds. It is the principal remedy for fungus diseases, is of some value as an insecticude, has a beneficial effect upon the plants independent of its effects upon their insect and fungus parasites and may be used for most purposes in place of water in the preparation of the arsenical sprays.

Bordeaux for winter use may be made as follows:
Copper sulphate, 6 pounds.
Unslaked lime, 4 pounds.
Water, 45 gallons.

BORDEAUX MIXTURE FOR PLANTS IN FOLIAGE.

Copper sulphate, 4 pounds.
Unslaked lime, 6 pounds.
Water, 50 gallons.

For a stock solution dissolve any number of pounds of copper sulphate (blue vitrol) in as many gallons of water by suspending in a burlap sack, so that the sulphate just touches the surface of the water. Keep the stock solution in a stoppered jar. Use an earthen or wooden vessel in the preparation of Bordeaux mixture as it will ruin a vessel of metal.

In some vessel slake slowly five pounds of fresh lime, using hot water, gradually adding water until a thin whitewash is formed. Take four gallons of the copper solution and add to 25 or 30 gallons of water. To this solution add through a strainer the line whitewash as prepared, adding sufficient water to make 40 or 45 gallons, stirring vigorously the while. Keep the mixture agitated while spraying.

BORDEAUX MIXTURE AS AN INSECTICIDE AND A FUNGICIDE.

By adding one-quarter pound of paris green to each fifty gallons of Bordeaux, the mixture becomes a combined insecticide and fungicide. Or arsenate of lead may be added instead of paris green—two or three pounds of the arsenate to fifty gallons of Bordeaux. Arsenate of lead, called disparene, unlike paris green, will not burn the foliage when applied in large quantities and it "sticks" better.

Preserving Fruits for Exhibition.

Fruits for preservation and show purposes should be put up when very firm, and for at least 48 hours after being put into the preservative fluid should be kept under a low temperature and in a darkened room.

Following are some of the preservative formulas:

Formalin, 1 pint.
Salt solution, 2 pints.
Water, 17 parts.

When made up, the solution will keep indefinitely. Another solution weaker in formalin has also been used here satisfactorily: The proportions are:

Formalin, 3 parts.
Salt solution, 10 parts.

Water enough to make 100 parts.

For Raspberries, the following mixture is recommended:

Formalin, 1 part.

Glycerine, 10 parts.

Water, 89 parts.

Strawberries may be preserved fairly well in a saturated solution of common salt, and better still in a fluid composed of formalin, 1 ounce; alum, 1 drachm; glycerine, 5 ounces; water, 3 pints.

Red Currants keep best in a solution of

Corrosive Sublimate, 1 part.

Glycerine, 10 parts.

Water, 90 parts.

The corrosive sublimate must be dissolved in hot water and the solution and fruit preserved in it should be labelled poison, as it is very deadly if swallowed.

The glass stoppers of bottles and jars may be made perfectly tight by smearing the ground surface with a small amount of light colored vaseline. This will also prevent in great measure the stilking of the stoppers when it is desired to remobe them, according to B. O. Longyear, of the Agricultural College, Fort Collins, Colorado.